

A
Weapon System
Survey

TANK!



The Magazine of Conflict Simulation

circulation: 28,100

Editor/Publisher
James F. Dunnigan

Art Director/Co-Editor
Redmond A. Simonsen

Editorial: Christopher J. Allen, Howard Barasch, Stephen G. Bettum, Frank Davis, Bob Felice, Irad B. Hardy, David C. Isby, Stephen B. Patrick, Sid Sackson, John Michael Young, Kevin Zucker. **Graphic Production:** Manfred F. Milkuhn, Joan Scott. **Administrative:** Margaret Davis, Patricia Dugan, Carl Jacobsen, Linda Mosca, George Murison, Bridget Murphy, Karlene Scott, Kathy Scott, Margaret M. Scott, Kathy Tennyson, Salvatore Zito. **Game Evaluation and Research Assistance:** Martin Campion, Edward Curran, Omar DeWitt, Bruce Evans, Steve Kuklin, Steve List, Leo Niehorster, George Phillies, Tom Walczyk, Malcolm Watson.

Original Editor and Founder: Christopher Wagner

Printing: Reflex Offset, Inc., College Point, N.Y. **Presswork:** John Banks. **Binding:** Apollo Bindery, College Point, N.Y. **Die-cutting:** Freedman Die-Cutters, Inc., N.Y., N.Y.

STRATEGY & TACTICS Magazine is copyright © 1974 by Simulations Publications Inc. Printed in USA. All rights reserved. All editorial and general mail should be sent to Simulations Publications Inc., 44 East 23rd Street, New York, N.Y. 10010. One Year (six issue) subscriptions are \$12.00 per year. Please send checks or money orders only. Basic ad rate is \$30 per thousand. Rate card available on request.

GREAT BRITAIN & EUROPE: British and European customers should place their orders for SPI products and subscriptions with SIMULATIONS PUBLICATIONS, UNITED KINGDOM, P.O. Box 46, Altrincham, Cheshire, WA15 6PE, United Kingdom. Basic subscription rate from SPUK is (Pounds) 7.50 per year.

Simulations Publications, Inc. does not usually consider for publication unsolicited games and articles submitted to S&T or Simulations Series Games. Frequently, however, unsolicited material dealing with game design or practice will find publication in MOVES Magazine. In all cases, SPI cannot assume responsibility for such unsolicited material.

The publication of paid advertisements in SPI publications does not constitute an endorsement by SPI of the goods or services offered. SPI does, however, attempt to prevent fraudulent or misleading paid advertisements from appearing in its publications. SPI reserves the right to reject any paid advertisements it considers misleading, or harmful, or offensive to the sensibilities of the editors and the readership.

Advertisements of SPI products are backed by a guaranteed credit or cash refund (upon prompt return of the product) if the buyer is dissatisfied or replacement if the product is damaged in transit.

S&T 44 Subscription Enclosures

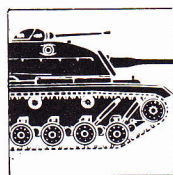
1. TANK Map
2. TANK Counters
3. TANK Rules
4. Combination insert of:
 - a. Special Offer
 - b. Feedback Response Card
5. Business Reply Order Form

COMING IN OUR NEXT ISSUE: The game will be Operation Olympic, the proposed invasion of Japan in 1945, with an article on the same topic plus an article on Science Fiction situations and their applications to games. Plus our regular features.

On the cover: a U.S. M-48 (U.S. Army photo)

In This Issue

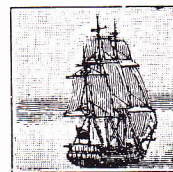
page



TANK! A Weapon-System Survey

5

Stephen B. Patrick



SEA WAR IN THE AGE OF SAIL 1650-1830

21

David C. Isby



Simulation: TANK! Armored Combat in the 20th Century

xs49

James F. Dunnigan
Redmond A. Simonsen

OUTGOING MAIL

The Editors

2

SACKSON ON GAMES

Sid Sackson

40

FOR YOUR EYES ONLY

The Editors

43

PASS IN REVIEW

Albert A. Nofi

45

FEEDBACK QUESTIONS

Vox Populi, Vox Dei

46

SIMULATIONS PUBLICATIONS, INC.

44 East 23rd Street, New York, N.Y. 10010. Telephone: (212) 673-4103

Outgoing Mail

"Outgoing Mail" is, primarily, a response to subscriber inquiries and questions. "Outgoing Mail" is also used to let subscribers know what's going on at SPI. What we're doing and what we plan to do. All of this directly affects subscribers. "Outgoing Mail" is written, for the most part, by Jim Dunnigan. The topics to be covered are provided by reader letters as well as odds and ends generated (and often written) by other SPI people.

First of all, for those of you who really like the Tank game in this issue, we have a special FREE OFFER. If you send us a stamped self-addressed, 9x12 manila envelope we'll send you a Tank Expansion Module consisting of another 200 counters and a set of expansion rules (which also includes additional vehicle

values and scenarios). You must send us your 9x12 SSAE before 31 July 74. The SSAE must have 40 cents in U.S. postage affixed to it (more if you are overseas). If you wish you may insert a "stiffener" in the 9x12 SSAE (a piece of corrugated cardboard slightly smaller than the envelope) but you must affix an additional 10 cents of U.S. postage for every ounce or fraction of an ounce that the stiffener weighs. Only one Expansion Module per subscriber (include your Customer Code with your request). Remember, you will only receive your Expansion Module if you follow the "rules" exactly:

1. The SSAE must be 9x12 or larger.
2. The SSAE must have 40 cents U.S. postage affixed.
3. You must clearly print your address on the SSAE.
4. You must send it to us so that we receive it in our hands before 31 July 74.
5. You must include your Customer Code with your request (Your code is the six letter abbreviation of your name found on the upper left-hand corner of the mailing label that this issue of S&T came in).

(continued on page 4)

Frigate

Sea War in the Age of Sail

Frigate is a game of naval warfare during the period when the Royal Navy of the British Empire was challenged for supremacy on the oceans of the world by the navies of other countries. *Frigate* simulates these great naval battles of the Eighteenth and Nineteenth Centuries in over a dozen different scenarios.

The scenarios include ships from the navies of Britain, the United States, France, Spain, Italy and Holland. They range in size from the two-ship action HMS *Guerriere* versus the USS *Constitution* to the seventy-ship action of the Battle of Trafalgar. The scenarios include Historical Notes that detail what actually occurred during that battle and gives a listing of the Orders of Battle. A new feature that appears in *Frigate* is the inclusion of Playtest Notes with each scenario. These Playtest Notes are the results of the SPI Friday Night Playtest sessions. They give tactical notes on each individual scenario and general hints on how to play the game.

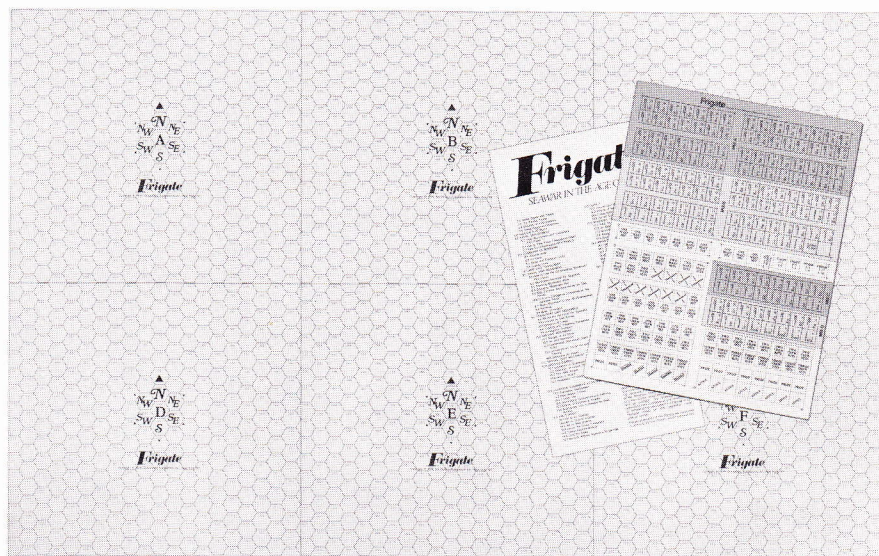
The mapsheet is a new system for SPI. It uses an "endless" geomorphic mapsheet. Six 10"x10 3/4" mapsection may be placed in virtually any configuration as the battle moves across the "sea."

The game-scale is 200 meters to the hex, each Game-Turn is eight minutes and each Movement Point is three quarters of a knot. Each counter represents one ship.

The counters have all information needed for playing *Frigate*. Gunnery Strength at various distances is shown along with Defense Strength and all-important facing. The number of guns each ship mounts and its identity code is also listed on the counter. The ships themselves are varied by nationality and type. They are as large as a 120 gun ship-of-the-line to a helpless merchantman.

As was the case in naval warfare of this era, wind is a critical factor. Two separate Wind Charts are included in *Frigate*. One Chart represents actual wind conditions as they exist; the other is a more interesting and variable Chart that puts an incredible amount of uncertainty into the game. Neither Player is ever certain of what will happen in the next Game-Turn. The entire tactical situation can be reversed by a sudden change in the wind.

- "Endless," six piece, geomorphic map
- Individual ships-of-the-line, frigates, corvettes, and sloops
- Simultaneous movement, wind effects, and Command Control



Another variable in *Frigate* that adds uncertainty to the game is explosions. There is always the chance that a lucky shot will blow up a ship. In this manner, a frigate can sink a ship-of-the-line.

Explosions can be particularly important with Preservation Levels. This is the point at which one side or another will decide that the losses have become too high to make accomplishing the mission worth while. A side can actually be on the verge of victory and have an explosion cost him the scenario.

Discipline is reflected by Command Control and training is shown in the Gunnery Ratings. Command Control can have its effect lessened through the use of Flagships (the ship that the Player is "on"). Of course, this makes Flagships prime targets of enemy ships. The Gunnery Rating gives an effectiveness rating to the firepower of the different ships and nationalities. The better trained the gun crew is the better their Gunnery Rating and the more devastating the effect of their firepower.

Frigate also uses a Simultaneous Movement system that makes movement and combat quite interesting. One interesting feature of the Simultaneous Movement is

running afoul of an enemy ship. This is the procedure of actually boarding a ship and engaging in hand-to-hand combat with the enemy crew. As Players will discover, the results can be quite unexpected. An optional rule in the game allows certain nationalities better firepower when running afoul. This is a "What if?" The French and Spanish emptied their jails to man their ships. As a result they had larger crews than their British counterparts but they were little better than an armed mob. This optional rule shows what might have happened if they were as well trained as the smaller British crews.

A final point is the capturing and re-capturing of ships. In the middle of a combat situation, a ship "striking its colors" can have quite an effect. Of course, the original owner of the ship may try to re-capture it to deprive the enemy player of its victory points. He may even attempt to sink it; it's better to have a ship sunk than captured by the enemy.

Frigate is a game that covers the legendary battles of naval history. Optional rules and various scenarios allow the game to be as simple or as difficult as a Player wishes.

Frigate is available (boxed) from Simulations Publications for \$8.00.

OUTGOING MAIL *(continued from page 2)*

6. Send your request and 9x12 SSAE to:
Simulations Publications, Inc.
Tank Expansion Module
44 East 23rd Street
New York, New York 10010

IMPORTANT NOTE: We cannot afford to follow up service complaints on this free offer, so if you don't follow instructions exactly, or if the Post Office damages or loses your Expansion Module altogether, you've had your roll of the dice, so to speak. Statistically, this means that 2% of you are going to experience some difficulty or other. If you "roll a six" on this fifty-to-one shot, we're sorry but we can't afford the staff time to chase down a stray free offer.

The primary reason that the Module wasn't included in the subscription game was, of course, economic. If we had included it in the regular mailing of the issue the added weight would have required us to send the issue out as Fourth Class individual parcels (instead of Third Class Bulk). This would mean an *additional* expense of some \$15,000 plus a delay in mailing time amounting to weeks. We felt that the fairest way to give the Module to those of you who like complicated games (without putting a giant hole in our budget and inconveniencing the subscribers who *aren't* interested in the game) was to offer it as a free premium.

As we mentioned in the last issue of *S&T*, we are planning to do a number of these game expansion kits. Generally, the expansion kit will be, in most cases, about four pages in length. It will consist of many of the more obvious and logical extensions of an existing game. In the past we had neither the time, money nor resources to produce these expansion kits. Now we do. And whenever possible we include this "expansion" material in the game as originally published.

Another benefit of our increased R&D capability will be the revision and republication of many of our games. You will note that the latest game rating survey contains 84 games. Of the bottom 21 rated games, 14 were SPI games. For one reason or another these low-rated games are no longer very acceptable. We feel that if a regular revision program for low-rated games would, if nothing else, increase their acceptability. Hopefully, it will also increase the sales of many of these games. Actually, some of the low rated games are also very good sellers. This, we feel, is unfortunate because many people are obviously buying the game on the basis of its subject matter and not because of its "game" quality. Many games, of course, have become obsolete. Obsolete because we have developed more effective game mechanics for the same situation that they cover. By the end of this year we will have revised and republished six existing games. Those will be *Grunt*, and the five pre-gunpowder tactical games (*Armageddon*, *Phalanx*, *Centurion*, *Dark Ages*, and *Renaissance of Infantry*). Early next year we hope to do *Combat Command* and *Red Star/White Star*. Present plans call for the revising and republishing of one older game every two months. Obviously, at this rate we're never going to catch up. But the number of games we do revise and republish is largely dependent upon the economics of the operation. If the republishing of older games improves sales enough, then this program will be economically valuable and we will speed it up. Our current market research data seems to indicate that a game has a "useful published life" of only some three years. In other words, every game on the average should be redesigned, revised and republished every three years. If nothing else, we're going to give it a try.

If you like the "Tank" article in this issue of *S&T*, you'll undoubtedly really enjoy the two articles coming up in issue 46. Both articles will deal with the same subject matter as a game. One game will be *Combined Arms*, which will be published in issue 46. The other game will be *Patrol* which will be announced in that issue. *Combined Arms* is a company level game with scenarios covering

Warfare from the 1930's to the present. Its purpose is to show the relationship between the three main combat arms (infantry, armor and artillery). *Patrol* was much like *Sniper*, except it is outside of the built up area, and unlike *Sniper* covers scenarios from World War I to the present. Therefore, one article in *S&T* 46 will cover Combined Arms problems and developments from the 1930's to the present. The other article (covering the *Patrol* game) will cover low-level infantry tactics from World War I to the present.

In this issue we have the *Frigate* article which will, no doubt, appeal to that large minority of you who are most interested in pre-20th century history.

Next issue, you might call our "science fiction" issue. One article will be on possible "distant futures." This article will complement the *Starforce: Alpha Centauri* game to be announced in that issue. The other article, also something of a science fiction article, concerns *Operation Olympic*, which is also the subject matter of the game in issue 45. *Operation Olympic* was the projected invasion of Japan in 1945, an invasion which was made unnecessary by the surrender of Japan shortly after the first two atomic bombs were dropped on Japanese cities. Of course, we have done "speculative" type articles before. Issue 42's *East Is Red* article was one such article of this type. In issue 47 we'll do another on a hypothetical World War III. This game, covering (believe it or not) the entire World, is a "conventional" World War III. The other article in *S&T* 47 will cover submarine warfare in the Atlantic from 1939 to 1945. This will complement the *Wolfpack* game in that same issue of *S&T*.

For those of you who found the list of retail outlets in *S&T* 43 useful, we will here give you a timetable for the release of new SPI games to the retail outlets. As we have mentioned before, we do not release new games immediately to the retail market primarily because of our inventory problems. By selling the games only through direct mail for about six months, we are able to get a better idea of what our inventory levels should be for the retail market. (Inventory is one of the biggest expenses of selling a game in the retail market, and thus we need this "advance information" in order to keep our retail marketing as "orderly" as possible.)

Due in the stores in July are *Bull Run*, *Desert War*, *Sniper*, *World War II*, *American Civil War* and the *East Is Red*. In September, *Tank* will appear in the stores. In October *Frigate*, *Seelowe* and *War In The East*. In November, *Operation Olympic*. In January, 1975, *Combined Arms*. And in March 1975, *Wolfpack*.

The SPI games are doing very well in the retail outlets. In fact, with only about half the number of Avalon Hill's retail outlets, we stand a good chance of *outselling* Avalon Hill in the retail market alone. Last year, we outsold Avalon Hill, but primarily through a direct mail approach.

One offshoot of our retail marketing of the games, has been that a lot more people are becoming exposed to the games. This often has very interesting side effects. For example, *Foxbat & Phantom* has caused some intriguing things happen. In the past few months we received two telephone calls from some people at Grumman Aircraft. The Grumman Company produces the F-14 Tomcat fighter, for the Navy. Their first call inquired about where we got the information on the Tomcat for the *Foxbat & Phantom* game. We told them that we had gotten a lot of it from magazines, and what few books are published, and what we weren't able to obtain there, we simply made up. A few weeks later we got another call, asking us essentially the same questions, and we gave them essentially the same answers. We suspect that the people from Grumman were not convinced. Hopefully, this will not result in yet another investigation of us by one Defense Department agency or another. Interestingly enough, we also were contacted by the McDonald Aircraft Corporation, which produces the F-15 fighter for the Air Force. The simply wanted to stock *Foxbat & Phantom* in the company store. Shortly after the publication of *The East Is Red*, we received a visit from a high-ranking Soviet diplomat, stationed in New York. He was interested in looking around, and also wanted to pick up a copy of *War In The East*.

Unfortunately, *War In The East* was not yet ready, so we just showed him around. During the tour, we came across a copy of *NATO*, which was being played. We asked him if he'd like to get a copy of it, to which he replied, "No, I believe we already have that one." About a month after that, we received a frantic telegram from the U.S. embassy in Moscow, requesting that we send, as quickly as possible, copies of (would you believe) *Borodino* and *1812*. We sent the games, Air Mail, Special Delivery, but have yet to learn exactly what's going on over there. A number of Army organizations are purchasing copies of *Sniper* as a "training aid" and the American Berlin Garrison has expressed interest in getting a simplified set of rules for *Sniper*, in order to use the game to enhance their street fighting capabilities. Three different U.S. military schools requested permission to reprint *S&T* articles, for training purposes, and finally, we received a request through American military channels, from the Rumanian General Staff, to receive *S&T* on a regular basis.

A few issues back we announced the availability of a newsletter called *DataBus*. *DataBus* is directed at those of you who have access to a computer, and are interested in using EDP for conflict simulation. Well, you'll be happy to know that *DataBus* now has two issues out, and another in the cooker, and has received sufficient subscribers support to keep it going. For those of you who might still be interested, a six-issue subscription costs \$5. If you want a subscription, send your \$5 to SPI, Attn.: *DataBus*. Since we are only guaranteeing publication for one year, right now you will receive back issues, as well as current ones, and future ones, up to issue 6, at which point we will decide whether or not to continue *DataBus* on a regular basis. So far, it looks pretty good.

A fairly persistent request from subscribers, is for *more*. More of everything. One thing subscribers would like more of is *S&T*. A third major article per issue is one fairly frequent request. It would be extremely expensive at this point to expand the size of *S&T*. To include one more major article would mean adding at least sixteen pages to the size of *S&T*. This would require that we spend at least \$40,000 the first year we do this. Thereafter, the cost would increase 10 to 20 percent a year, because of inflation and increased circulation of the magazine. For this amount of money, we could publish at least four new games a year. Needless to say, we have a lot more uses for \$40,000 other than an extra article in *S&T*.

We receive a constant stream of criticism and comments on the articles in the magazine, as well as the games. Some of these criticisms would appear, to the majority of you, to be rather far-fetched. For example, in the past few years we have received a few letters asking why we don't publish the games "half-finished." This way, those suitably inclined could finish the games to their own liking. All they want, really, is a bit of help to get them going in the right direction. For obvious reasons we don't do this. Our experience has shown time and again that the vast majority of game buyers want a very "finished" product. However, there lurks within almost every game player, a game-designer. And it is partially for this reason that we are now producing expansion kits for existing games. In addition, *MOVES* Magazine has always directed a large amount of its material in this direction, but we doubt if we'll ever be producing half-finished games.

On the subject of *S&T* articles, we received comments and criticism concerning omissions, and questionable accuracy, as well as writers' bias. The omissions and accuracy questions are endemic of the "article" format. Were we reproducing book-length materials on the subjects covered in *S&T*, we would be able to eliminate many of the omissions and accuracy problems. The omissions of certain material is almost exclusively a question of limited space. The accuracy problem is also, to a large extent, a question of limited space. Data must often be consolidated and simplified. This, to the purist, produces what appears to be inaccuracies. But, since the data in articles, as well as the data in the games, must be analysed and, as a consequence, modified data will at times appear inaccurate, compared to its original source material. Admittedly, however, there

(continued on page 20)

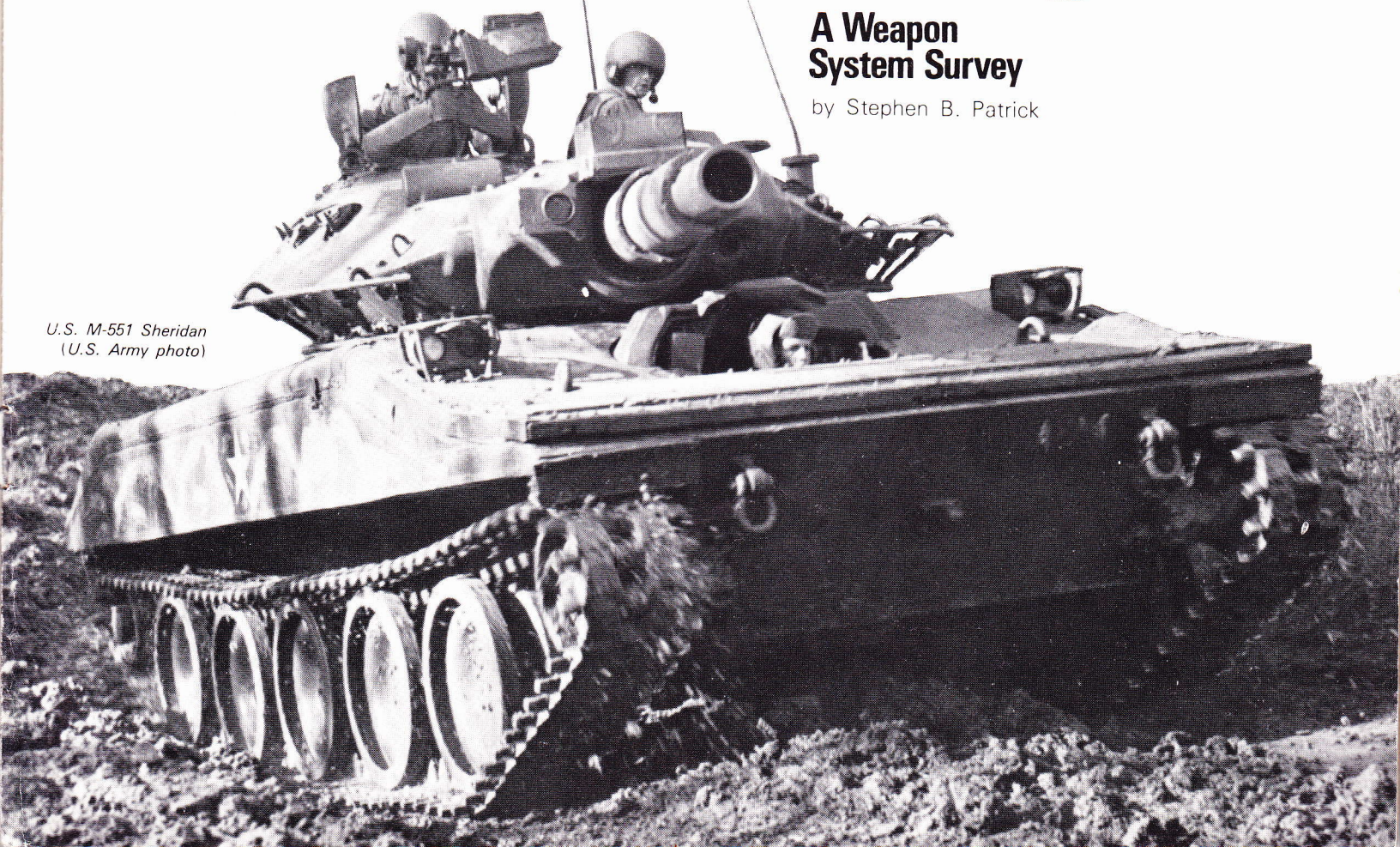
Tanks. The word usually conjures images of a fleet of iron monsters churning up ground, spewing machinegun bullets, with cannons belching fire and destruction. Think of a colorful leader in World War II and men like Patton, Rommel and Montgomery come readily to mind — all men associated with tanks. Think of great military theorists after World War I and again men like Liddell-Hart, Guderian, De Gaulle and J.F.C. Fuller come to mind — also men associated with the development of tanks and tank doctrine. The first image is largely a product of Hollywood; the second wrongly ignores the equally colorful airborne and infantry commanders; the third has a germ of truth because tanks were the most significant development to be introduced to ground combat since the machinegun.

TANK!

A Weapon System Survey

by Stephen B. Patrick

U.S. M-551 Sheridan
(U.S. Army photo)



Tanks do create an aura of their own. To men who work with them, known to the trade (at least in the U.S.) as "tankers," tanks are capable of doing everything except walking on water, and that only because the tank designers haven't really set their minds to the task. Probably no other piece of machinery occupies as personalized a position in the modern arsenal as a tank. In the French, West German, British and American armies, only tankers routinely bestow names on their equipment. Certainly in combat one can find artillery pieces and even APC's named by their crews. But in peace, as war, unless someone decrees that it will not be done, tankers name their tanks. Actually, this is not so unlikely as it may seem. Only the tank, of the major equipment available to ground forces, serves not only as a means for waging direct combat, but also as the primary source of protection for the people using it. If an APC is knocked out, the infantry men proceed on foot. But this is their ultimate task in any event. If an artillery piece is knocked out, its firepower is lost, but its loss usually won't mean leaving the crew stranded — or worse — exposed in the *middle* of the battlefield.

Obviously, tanks are not superhuman (nor, indeed, are they even human, tanker's opinions to the contrary notwithstanding). They do have their limitations. The real problem, over the past fifty-odd years has been a general confusion over their limitations and an inability to properly exploit their abilities.

People have wanted tanks to be all things and then have given up on them when they find they have limitations. A classic example was the erroneous conclusions drawn during World War II to the effect that the Blitzkrieg was a thing of the past after 1942, and the resultant elimination of armored divisions from the British army during the war, with a corresponding diminution in the U.S. Army after the war. Only the Soviets did not labor under this misapprehension and kept their armored strength up. Yet they had been fighting the same enemy as the western Allies. Why did they reach opposite conclusions? The most likely reason is because they did not overestimate tanks' abilities to begin with and were therefore not disappointed.

A DEFINITION

The problem of determining how properly to use a tank is underscored by the breadth one

must give to any definition of a tank to include the various pieces of equipment which have, at one time or another, been called tanks. Basically, it is a track-laying vehicle, fully tracked, having armored protection and mounting either a machinegun or cannon, designed to engage the enemy in direct combat. Those familiar with current U.S. Army doctrine know that the mission of armor is "to close with and destroy the enemy by means of firepower, shock action and maneuver, in coordination with other arms." Tanks are, accordingly, designed based on the desire to fulfill that mission. The fact is, however, that at the start of World War II, only Germany conceived a tank's mission to be anything like that.

S&T 41 had a good history of the development of tanks during the inter-war years and there is no need to repeat it here. The major development was the general abandonment of the rhomboidal design initiated by the British, with side-mounted sponsons and over-running track in favor of a rotating turret in the fashion introduced, primarily, by the French in the Renault FT.

But beyond that there was no mutually agreed design, and by no means was the sponson-mounted gun concept totally abandoned, nor was a suspension system which carried the tracks almost as high as the whole tank, as several French tanks and the pre-war German PzKpfw VI showed. The main reason for the variety of tank designs was a general lack of agreement as to how a tank should be used. Tanks, in the inter-war years, were filling various roles in various countries — infantry support, cavalry support (and/or substitute) and pure tank. As a result, there were light tanks, medium tanks, heavy tanks, cruiser tanks, infantry tanks, and cavalry tanks. They were mainly armed with machineguns and light cannon and all had rotating turrets. Beyond that, tanks looked very dissimilar, even when made by the same country.

The major development of the Second World War was in the area of armament. The table showing tank armament comparisons reflects the steady increase in the main armament calibre.

The primary reason for this was the German doctrine of Blitzkrieg. The results of the Polish and, more importantly, the French campaigns, showed that the Germans had fixed on a highly

successful tactic for using tanks. Further, it showed that the preconceived notions on tank employment of other nations were not very viable.

The fact is that the campaigns in Poland and France were fought with the PzKpfw I, II and III, as well as the 38(t) Czech tank. The Germans had viewed these tanks as stop-gaps in any event, with the PzKpfw IV to be the main tank and the PzKpfw III retained as a light tank. As it was, the PzKpfw IV was only available in limited numbers until the invasion of the USSR, and its role was filled by the PzKpfw III. In effect, the most famous campaigns of the Blitzkrieg were fought with admittedly inadequate tanks. The effectiveness of the doctrine overcame the disadvantage of equipment.

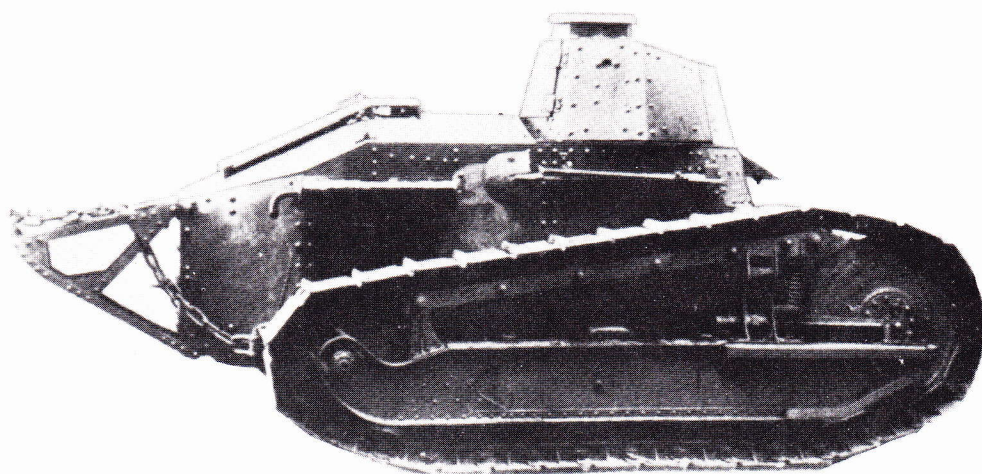
In reaction to this new concept of warfare, tanks became the vogue. Relegated to a support role in many armies, they were suddenly seen as the cutting edge of combat. The old idea of tanks as mobile pillboxes, to support the infantry (which was a stated mission of tanks in the U.S. Army after World War I) saw tanks advancing at an infantry pace, even with or slightly behind the main line of infantry. Those nations using tanks as cavalry substitutes were intrigued by the firepower now available to their screening and scouting forces, but made no provision for hard combat in terms of strong armor. Their tanks, accordingly, were underarmed and under armored, though mobile, while the infantry support tanks were sluggish and adequately armed only for infantry support. Those who had the foresight to conceive of tanks as an offensive weapon in their own right had usually gone overboard and made pure tank units. They found that tanks, even in great numbers, must work in coordination (though not subordination) with other arms — primarily infantry. Again, the article in *S&T 41* discussed the infantry-tank mixes tried by various armies prior to and during the early years of the war.

In up-gunning and up-armoring tanks, people reached the conclusion that one of the main uses of a tank was as a means for killing other tanks. This does not mean that the primary mission of tanks was to destroy other tanks, merely that they were well-suited for the job. Prior to the war, towed anti-tank artillery was given this mission to the exclusion of tanks. Obviously this is not a conclusion which couldn't have been reached by using some foresight. But since the common wisdom of the pre-war era was that trench warfare was still effective, the thought that anti-tank artillery could not be readily pre-positioned to create strong points did not occur to most military thinkers (or was passed off as possible but unlikely). The tank, as used in the Blitzkrieg, created a fluid battlefield in which positional warfare was suddenly obsolete. Towed artillery could not be blithely set up in sure knowledge that tanks would have to come into their range. Obviously, anti-tank artillery continued to have a use in the war, but not what had originally been conceived for it.

UP-ARMORING

Recognizing that tanks were suitable for killing other tanks implied recognition that the other fellow could reach the same conclusion. Thus, up-gunning and up-armoring tended to go hand in hand. The vogue in tank armoring, prior to the war, was often riveted construction. It is quick and could take the kind of enemy fire conceived prior to the war, but it couldn't do

French Renault FT



so well against cannonfire from other tanks. Thus, riveted construction disappeared quickly. The successor was welded construction. Rolled steel plates were used. This had the immediate effect of producing more angular tanks. It wasn't long before increased firepower made it apparent that heavier armor was required. However, with the power plants then available, the designers simply could not get carried away with heavy armor. The alternative solution was to find a way to make the existing thicknesses more resistant to gun fire. Homogeneous, rolled armor plate was one solution. Another was to add a slope to the armor, particularly on the glacis (the front of the body of the vehicle) since that is the part most likely to be exposed to enemy fire. By moving the armor plate out of the vertical, toward the horizontal, a projectile striking the armor must now penetrate an effectively greater thickness. This increased thickness in terms of the amount of armor which must be penetrated by a round moving horizontally is called the "basis" and a tank with, for example, three inches of armor inclined at an angle of around 60° from the vertical will have a basis of approximately five inches.

Another means of increasing armor protection is making use of the fact that if a projectile strikes a shallow angle with reference to the armor, it will tend to skip. This ballistic protection resulted in an additional reason for a sloped glacis, as well as a desire to avoid any vertical surfaces, which would afford a good target for a projectile. Although casting does not make as strong a piece of armor as homogeneous, rolled armor, it does allow rounded surfaces which cannot be achieved with plates of armor. This rounded effect is most commonly used on turrets and the bows of a tank since, again, these are the areas most likely to be subjected to enemy attack.

Casting is more time consuming and expensive. As a result, the Germans tended to retain welded plate armor, even in their largest tanks, while the Americans and Soviets adopted cast turrets and bows (if not the entire hull).

THE PRICE OF IMPROVEMENTS

Nothing comes free, especially in equipment development. Larger gun calibres required larger turrets to absorb the thrust of recoil and afford room for the gun recoil, as well as to transport the larger rounds of ammunition (though the number of rounds in a basic load of ammunition invariably declined as the tanks got larger). The heavier recoil also required a heavier tank so that a stable gun platform could be maintained. [A current example of this problem is the M551 Sheridan. When firing the conventional round, the front two road wheels literally jump off the ground from the recoil and the gunner generally risks a black eye unless he is particularly careful.] Further, the increased armored plate made its own weight increases. This compelled further changes because the increased weight proved beyond the abilities of the then-existing engines and strained the suspension system.

Building a more powerful engine, as it turned out, was generally not the hardest part of the task, though making these larger engines more reliable was a problem. Still, as can be seen from the table of comparative weight per horsepower, tanks generally lost mobility during the war as the weights kept ahead of the engines.



A platoon of PzKwI's fording a stream in a pre-war exercise.

SUSPENSION

Suspension systems posed an entirely new problem. The earliest tanks simply had no particular suspension system. The track ran over a series of small rollers, with tension controlled by moving one of the wheels in or out. Nothing absorbed transit over rough ground other than the tank itself — and the crew. The first system adopted was to simply mount the wheels that made contact with the track where it lay on the ground, on a series of coiled springs. Alternatively, the wheels were sprung on leaf type springs, much like early automobiles. The PzKpfw II clearly shows the leaf spring suspension system. America's prophet without honor, Christie, used a "snubber" effect, mounting the roadwheel on a moving arm which would snub against a coiled spring in a cylinder. The Americans, however, favored the bogie wheel system — a two or four wheel arrangement with the wheels pivoting on the fixed mount. They used, initially, a vertical volute system, with a coil voluted spring mounted vertically, though in the last stages of the war they adopted the horizontal volute suspension system (HVSS).

It was the ubiquitous Dr. Ferdinand Porsche who devised one of the most effective systems: the torsion bar. A roadwheel was mounted on an arm. The arm was fixed to one end of a torsion bar. The bar had a series of

splines (ridges) on both ends so that when the other end of the bar was fitted in position on the far side, the bar would not turn. Instead, it twisted and in so doing, absorbed the movement. Since the torsion bar offers greater resistance the more it is twisted, this tended to smooth out bumps in a way no spring could. The torsion bar has several drawbacks over the spring system. Most springs could be replaced relatively easily. The bogie wheel system allowed you to remove the entire mount. Torsion bars passing the whole width of a tank not only forced elimination of hull bottom escape hatches where the bars ran, but had a demoniacal habit of breaking in such a manner that the short end is the farthest one. This meant welding a long rod onto the stump in order to draw it out and required several hours of work. The torsion bar first appeared on the late model PzKpfw II and III and was standardized thereafter on German tanks until the last proposed series, the E series, brought out a new system. This was a stack of Belleville washers, or disc springs, which store a great amount of energy in relation to their size. However, the only tank to actually reach production using it is the Swiss Pz 61.

The importance of a suspension system is multi-fold. It affects a track life because the track no longer has to absorb the whole shock of moving over the ground. More important,

(continued on page 10)

Guns & Ammunition

Tank guns and their ammunition are somewhat a chicken-egg situation. A given calibre permits certain limits in its ammunition. When a more powerful round is desired, new gun calibres are adopted, precipitating a new round of development in ammunition.

The first type of ammunition was a kinetic energy round. It threw a slug of metal at such a high velocity that it punched its way through armor. More than any other factor, it has been the kinetic round which has led to larger and larger calibres. The kinetic round depends on speed. To penetrate the increasing thicknesses of armor, as tanks were developed, greater and greater speeds were required. There is a formula which one can use to compute the velocity required to penetrate a given thickness of armor:

$$wv^2 = kd^3\left(\frac{t}{d}\right)^n$$

where "w" is the weight of the projectile in pounds; "v" is the velocity in feet/second; "k" is a constant of around 106 for typical armor and projectiles; "d" is the diameter of the projectile in inches; "t" is the thickness of the armor that the projectile will just penetrate and "n" is a figure of about 1.4. Those who like mathematics can play with the formula to get some firm figures. The essence of the formula is that, given an increasing thickness of armor (t) and a specific calibre (d), you have to increase the weight of the projectile and/or the muzzle velocity in order to penetrate. It is easier to increase the muzzle velocity, alone, if possible, since a heavier round will require more charge just to *maintain* the muzzle velocity. However, increased muzzle velocity, as firing increased weight of projectile, is purchased at the price of greater propellant power and, accordingly, greater forces exerted on the gun tube. There are metallurgical limits to how much force a gun tube can stand. Moreover, the force of recoil increases as the propellant charge increases. There is limited space in a turret. In an anti-tank gun, the force of firing can be absorbed through a long recoil, if necessary. Tanks don't have that luxury in terms of space and accordingly, a great deal of the brunt of firing must be borne by the gun trunnions. Again, there are limits to how much force they can stand before the gun jumps out of its mount. Thus, increasing propulsion charge has an outer limit for any calibre.

There is also an outer limit on the size of the round which can be fired by a tank. It is contingent on the weight of the round since it must be capable of being maneuvered into the breach. The U.S. M103, the British Chieftain and the German Jagdtiger all went to a separate charge and projectile. Normally the whole round is self-contained. But at the weight of a typical shot round for a 120mm gun, it begins to get beyond the ability of a man to lift both propellant and projectile, hence they are separate. In the U.S. and Germany, this means adding a second loader and, in U.S. terms of time within

which to fire, it adds another five seconds to the time within which fire can be brought on a target.

The problem was to find a way of accelerating a projectile of manageable weight to penetrating velocities. The first solution was "Armor Piercing, Composite, Rigid" (APCR) which had a high density core and low density jacket. It was, therefore, lighter than a conventional AP round of the same calibre and though it had about the same muzzle velocity, the high density core separated from the shell on impact and, having a smaller area, concentrated the kinetic energy on a smaller point. Referring back to the formula, one way to get greater penetration, if velocity remains the same, is to decrease the *diameter* of the projectile (d). However, being a light projectile, while maintaining the same surface area as a regular AP round, its velocity falls off rapidly at increased ranges. To eliminate this fall off in speed (which negates the value of the smaller core at longer ranges) the logical solution was to find a way to accelerate a small projectile without getting back into the problem created by the limits of a low calibre gun.

The answer was "Armor Piercing Discarding Sabot" (APDS or Sabot). It, too, has a hard core, made of tungsten-carbide. However, the shell around the core, or sabot, fell away within a few hundred feet of the muzzle, allowing the small, dense core to move on at the same rate as if it had been full calibre. This allowed another 1000 fps in muzzle velocity over what could be achieved with a full calibre projectile. As it is, it moves at a rate of about 4500 fps. At this speed, it is difficult to use at short ranges since it moves too fast for the average eye to detect at ranges less than 2000 meters. In addition, increasing the muzzle velocity does considerable damage to the gun tube. In the M60 tank, each round of sabot wears the gun tube five times as fast as a target practice, inert round. Thus, the number of sabot rounds a tank can fire is considerably less than the number of other types of rounds.

On the other end of the spectrum, among tank ammunition, is the high explosive round. It is the type most similar to the conventional artillery round since, as its name implies, it carries an explosive charge and relies on that to do its damage. Accordingly, it does not usually have very great muzzle velocity. In the gamut of rounds carried, the HE round is one of the slowest. It has particular value against thin skinned vehicles, such as personnel carriers, which are good targets for tanks in their capacity of protecting friendly infantry. An interesting variant on the HE round is High Explosive, Plastic (HEP) or High Explosive, Squash Head (HESH), as the round is known in England. It relies on detonating a plastic explosive which, when the round impacts, makes a small "puddle" on the surface of the target and then is detonated. This, of course, all happens in a

fraction of a second. On thin skinned vehicles this will generally burn right through and create a hole. If you hit a tank with a HEP round, more often than not, nothing will happen except a spot appearing which looks like it has been melted. However, in about one out of every five or so hits, the round will create sufficient shock waves in the armor to cause it to spall or flake off inside the tank. This occurs even though the armor is not pierced. The result is a conical area, base toward the inside, where small flakes of metal have been spalled off. The result of spalling, among crew members and to the instruments, is deadly. At the armor school they like to trot out a half bushel basket full of these flakes, all caused by one hit. The problem is that it took seven hits before one finally set up the spalling effect to produce the damage. As a consequence, high explosive rounds are not the ammunition choice in tank-to-tank engagements.

The third major round in tanks is peculiar to larger calibre tanks. A 76mm gun could not have a shaped charge round. This shaped charge round, "High Explosive, Anti-Tank" (HEAT) works on the phenomenon that the force of an explosive does not depend on its volume so much as on the surface which is exposed. The explosive has a cone cut out, base forward, which cone is lined with copper. When it detonates, the entire surface of the cone ignites, focusing its explosive force in the area set off by the base of the cone. It produces a jet of copper moving at a rate around 24,000 fps and can pierce any known armor. However, in order to work properly, it has to be somewhat removed from the target. Usually this stand-off is on the order of 3.5 to 4 times the calibre of the shell. The stand-off is achieved by means of a spike on the tip of the projectile. This spike also serves to detonate the charge. It gives the HEAT round its distinctive appearance.

However, HEAT must not only penetrate a target, it must do damage. The normal tendency given a target thicker than can be penetrated, is to burn into the metal in such a way that a reverse cone is created, widest at the surface and coming to a point somewhere into the metal. Thus, in order to do damage, the round must not only penetrate, it must have enough power to more than penetrate by an ample margin. This is why smaller calibres cannot fire HEAT — the "over-kill" capacity is not available at those sizes.

HEAT is a slower round than a kinetic round since it does not depend on the speed with which it hits the target to do its damage. Anything HEAT can hit with sufficient force to detonate the charge can be killed. Therefore, the usual rate is between 3000 and 4000 fps.

HEAT has a unique problem. The spin imparted by conventional rifling reduces the penetration of HEAT by as much as half. Some attempt has been made to fin-stabilize the HEAT rounds and use an unrifled tube, but this lacks accuracy. The

U.S. and Germany fire fin-stabilized rounds but use rifled tubes, accepting the reduced effect produced by spin. The French spin-stabilize the round, but the projectile is mounted on ball bearings so that it does not rotate. As a result, their 105mm HEAT round can penetrate 400mm of armor and is the sole armor-defeating round used by the French.

There are a few other rounds in the tank basic load. White Phosphorus (WP) makes smoke and can also be used to start fires and as an anti-personnel round. Canister rounds of various types are found on some tanks. This is an anti-personnel round and cannot be fired over the heads of friendly troops because it turns the tank into a giant shotgun.

For every anti-tank round, there is a counter, of sorts. HEAT and HE can be thwarted by using spaced armor. These rounds can't pick and choose between targets — they detonate when they hit something. Setting thin armor a few feet away from the true armor will suffice to detonate these rounds at a distance where they cannot damage the main armor. Kinetic rounds are somewhat harder to defeat since they keep on moving until they run out of kinetic energy. Spaced armor is of limited value against them. The best solution is a close attention to ballistic positioning of armor — well sloped and curved armor will create the highest incidence of skipping, i.e., causing the round to glance off the surface of the armor.

The rounds of choice in tanks vary from country to country. The U.S. favors HEAT for frontal engagements and Sabot for flank shots. HEAT is the most numerous round in the standard U.S. basic load. The French use HEAT exclusively while the British and Swedish do not carry HEAT at all. They rely on APDS, as does Switzerland. The Soviets, apparently, have a similar array of ammunition to the U.S.

Comparison of Muzzle Velocities of Current Tank Rounds

(Velocities in Feet per Second)

Tank	HEAT	APHE	HE	APDS	WP	Canister	HESH/HEP	AP	HVAP	Missile
Fr. AMX30	3048	—	2300	—	—	—	—	—	—	—
Ja. STB	—	—	—	4820	—	—	2400	—	—	—
Ge. Leopard I	—	—	—	?	?	—	?	—	—	—
Swe. STRV 103	—	—	?	4500	?	—	—	—	—	—
Swi. Pz 61/68	—	—	1990	4820	1990	—	2400	—	—	—
GB Centurion Mk 13	—	—	—	4822	?	?	2227	—	—	—
GB Chieftain MK 5	—	—	—	4500	2400	—	2400	—	—	—
GB Vickers MBT	—	—	—	4822	?	?	2227	—	—	—
US M48A3	2800	—	2400	—	—	?	2700	2800	3825	—
US M60A1	3840	—	—	4820	2600	?	2600	—	—	—
US M60A2	2240	—	—	—	—	2240	—	—	—	?
USSR T54/55	—	3280	?	?	—	—	—	—	?	—
USSR T62	—	?	—	4900	—	—	—	—	—	—
USSR T10M	2940	3116	2625	—	—	—	—	—	—	—

— = not carried on this tank

? = carried but data unknown

Comparison of Tanks and Destroyers Using Same Chassis

TANK	GUN	TANK DESTROYER	GUN
<i>Germany</i>		<i>Germany</i>	
PzKpfw 38(t)	37mm	Hetzer	75mm
PzKpfw III	37-50mm	StuG III	75mm
PzKpfw IV	75mm	Jagdpanzer IV	75mm
PzKpfw V	75mm	Jagdpanther	88mm
PzKpfw VI	88mm	Elefant	88mm
PzKpfw VI	88mm	Jagdtiger	128mm
<i>United States</i>		<i>United States</i>	
M4A2	75mm	M10	76mm
M4A3	76mm	M36 Jackson	90mm
<i>USSR</i>		<i>USSR</i>	
T34/76	76mm	SU85 & 100	85mm/100mm
Pt76	76mm	ASU 85	85mm
<i>West Germany</i>		<i>West Germany</i>	
Marder	20mm	Jagdpanzer 4-5	90mm

Main Armaments of Main Battle Tanks

COUNTRY	1920	1930	1940	1945	1955	1965	1970
<i>United States</i>	57mm (Mk VIII)	47mm (T2)	75mm (M3 Lee)	76.2mm (M4 Sherman)	90mm (M48)	105mm (M60)	105mm (M60)
<i>USSR</i>	(none)	76mm (T24)	45mm (BT7)	85mm (T34/85)	100mm (T54)	100mm (T55)	115mm (T62)
<i>Germany</i>	(none)	(none)	37mm (PzKpfw III)	75mm (PzKpfw V)	90mm (M47)	105mm (Leopard)	105mm (Leopard)
<i>France</i>	37mm (Renault FT)	75mm (Char 2C)	75mm (Char B)	76.2mm (M4 Sherman)	90mm (M47)	90mm (M48)	105mm (AMX30)
<i>Britain</i>	57mm/6pdr (Mk VII Male)	47mm/3pdr (Vickers Med Mk 1)	40mm/2pdr (Cruiser Mk IV)	77mm (Comet)	105mm (Centurion)	105mm (Centurion)	120mm (Chieftain)

(continued from page 7)

tanks can achieve greater speeds without battering senseless the crews inside them. The better the suspension, the faster one can move. The fact is that, as anyone who has ridden in a tank can attest, no other vehicle affords as smooth a ride across country as a modern tank.

CONVERGENT TRENDS

In making these developments, in an example of parallel evolution, people in various countries were drawing similar conclusions from the battle results and were recommending similar changes in their countries' respective tank programs. Some were outright steals from one country by another, such as the general hull configuration of the Panther as compared to the T34. Others were genuine similarity of conclusions as to how to best use tanks and design them for that use.

The multiplicity of turrets gave way to one centrally mounted, single turret (some early tanks had as many as *seven* turrets). A coaxial machinegun was fitted in the gun mantlet so that it could be fired by the gunner at any target he could see. Tracks became wider to

support the heavier tanks and to give a greater crosscountry ability. Generally, a bow machinegun was mounted and, accordingly, the typical medium tank crew was five men, though more were sometimes carried. This is in contrast to the eighteen needed for Germany's A7V in World War I. Commonly, a third, anti-aircraft, machinegun was mounted on the turret and fired by either the tank commander or the loader. The calibre of this machinegun varied from country to country in that the Germans favored having it the same calibre as the coaxial machinegun (7.92mm) while the British and the Americans used the heavier cal .50.

Generally, Soviet and British tanks had rear mounted engines and rear drive; the Americans had rear mounted engines and front drive. The Germans, who moved their engine from front to rear with the Panther, also retained a front drive. Other common trends were the use of support rollers by the British, German and Americans while the Soviets used a modified Christie system, having the tracks returned by the road wheels (modified, that is, because the true Christie system ran power to the road wheels while the Soviets did not

power anything but the drive sprocket). The Germans adopted a similar system after the PzKpfw IV.

THE ANTI-TANK MISSION OF ARMOR

One of the problems which remained unresolved during the war, curiously, was where the primary anti-tank mission lay. Did it lie with the tanks themselves or with other vehicles and equipment? Despite the proven success of tanks in defeating other tanks, every army had separate anti-tank equipment. The anti-tank artillery has already been mentioned. Later, small, rocket propelled anti-tank missiles were used (the bazooka and *Panzerfaust*). But the real curiosity was the anti-tank vehicle.

The Americans favored heavily armed, but lightly armored vehicles. Initially they used the standard half-track configuration (thereby giving the anti-tank branch its symbol). Later they created fully tracked anti-tank vehicles, most of which were based on the Sherman chassis — for example, the M10 and M36 Jackson anti-tank vehicles which had open turrets. These vehicles were also used by the British. The Germans, on the other hand, developed heavily armored, turretless versions

Anti-Tank Warfare

What actually destroys a tank? The best estimates we can obtain from World War II and later experience indicates the following figures to be reasonably correct: 39% of tanks destroyed due to armor-piercing shell; 20% due to mines; 14% due to infantry anti-tank weapons, primarily rocket-launchers; 9% due to Shaped Charge Shell or HEAT; 7% due to high-explosive shell, most of this being fired by conventional artillery; 6% due to air power; and 5% due to abandonment or miscellaneous non-combat causes, primarily either crew demoralization and/or mechanical failure in the vehicle itself. Overall, 60% of the tanks that were "destroyed" were repairable. 80% of the tanks knocked out due to mines were repairable. 40% of those knocked out by armor-piercing shell were repairable. 40% of all tanks hit were burned out, that is, they caught fire. 34% of turret hits caused fires; 45% of hull hits caused fires. 65% of all hits were on the hull; 10% were on the lower hull or suspension; and 35% were on the turret. Less than half of all hits were made on the frontal armor. Oddly enough, if a tank was destroyed, the crew was not necessarily destroyed with it. In fact, the average deaths in the crew of a destroyed tank was only 1.3 men per tank for the war. Also, only 75% of all tank crew casualties occurred inside the tank. This goes to remind us that tank crews did not spend all of their time in the tank. In fact, they spent the majority of their time *outside* of the tank.

Mines, of course, were a constant danger to tanks. At the same time, they did more damage to the tank itself than they did to the crew. Mines were difficult to detect by tank crews and fairly simple for enemy

units to employ. Also, mines were likely to be encountered in areas where enemy forces were no longer present. Thus, tanks were often knocked out by mines when the tank crewmen least suspected it.

We generally think of tank knock-outs being caused by anti-tank guns. Either guns mounted on tanks themselves or what we normally think of as unarmored, towed anti-tank guns. As you can see from the previous figures, less than half of all tank losses were caused by direct-fire artillery, and many of these losses were inflicted by other tanks. The anti-tank gun was still very important because, unlike the mine, it was extremely mobile and flexible. The Russians, who probably had the greatest amount of experience with anti-tank guns, estimated that a good anti-tank gun (76 or 57mm) could knock out two to three tanks, on the average, before itself being destroyed. This, of course, assumed that the anti-tank gun was able to fight on its own terms. If the Germans had their way they would shoot up the anti-tank guns while they were not "in place." But as the war went on, the anti-tank gun crewmen became more and more adept at having their relatively less mobile weapon employed whenever enemy tanks showed up.

The Russians used anti-tank guns mainly as an attrition weapon. They expected to use anti-tank guns to wear the enemy tank force down. The Germans, of course, did the same thing, and quite successfully, particularly in North Africa. The anti-tank guns served the purpose of a shield, taking all the punishment and blunting the enemy's offensive weapon. The defenders then, of course, counterattacked with their own tanks. The key to anti-tank gun

warfare was defense in depth. The Russians learned this the hard way. In 1941 they had an average of only one to three guns per kilometer of front, and these were emplaced to a depth of only three to five kilometers. By the end of 1942, with the Stalingrad operation, they had four to nine guns per kilometer of front echeloned from eight to twelve kilometers in depth. By the spring of 1943 the Russians were using five to ten guns per kilometer, again echeloned eight to twelve kilometers in depth. The Battle of Kursk was the high point of anti-tank warfare on the eastern front. During this campaign the Russians were normally using 14 to 20 anti-tank guns per kilometer of front, echeloned 30 to 35 kilometers in depth. By the end of the war, in early 1945, the Russians were using 20 to 25 anti-tank guns per kilometer of front, echeloned 30 to 50 kilometers in depth.

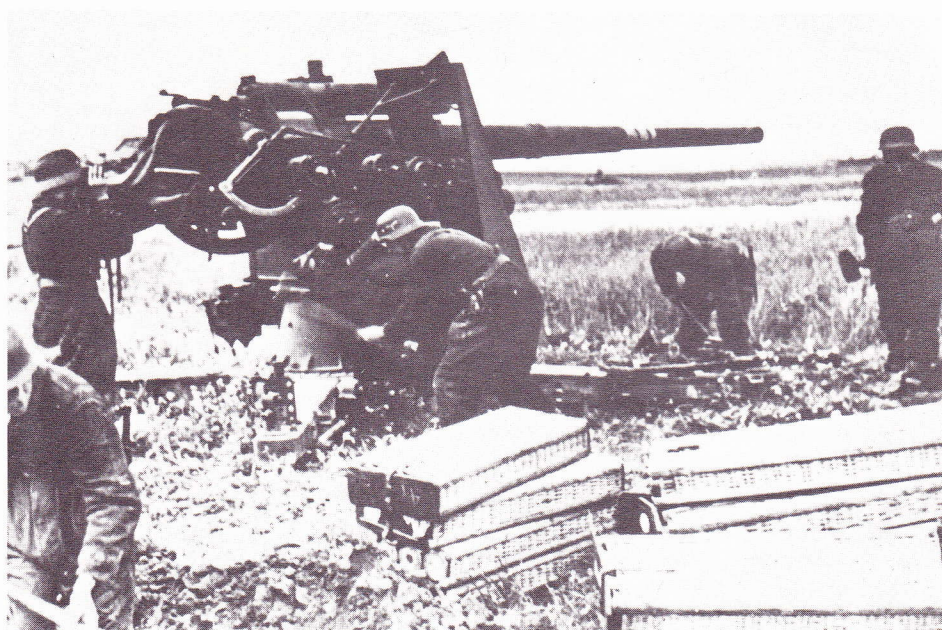
Russian anti-tank defense was based upon the anti-tank strongpoint which consisted of three to four anti-tank guns and four to eight infantry squads, also armed with light anti-tank weapons. A Russian anti-tank regiment, for example, had six four-gun batteries. The individual guns were emplaced usually within 500 meters of one another. The actual rule of thumb was that each gun should be one-half the killing distance from another gun. The killing distance being determined by the longest range at which the gun could obtain an effective hit on the enemy tanks it was expected to face. This killing distance was based upon getting a hit in the side of the tank since the frontal armor on most tanks, both Russian and German, was too thick to permit kills at anything but the shortest ranges.

of their existing tanks, using the normal tank chassis for these vehicles. Almost every tank chassis had an anti-tank variant in Germany. More often than not, these vehicles mounted a heavier gun than their tank counterparts, as the table comparing tanks and their anti-tank variants shows. The Soviets also produced a turretless anti-tank vehicle mounted on the T34 chassis.

COPING WITH INCREASED RANGE

Some areas were not really explored in the war. It would appear that not much thought was given, initially, to tanks having to engage targets at any substantial range. Having not really planned to use tanks against other tanks, one could anticipate using the main gun against targets at rather close range without risking destruction of the tank. Obviously, this notion had to be abandoned once tanks began to be used against other tanks. But in consequence of this initial conception, no real work was done on rangefinders. The general rule was that range was estimated for the gunner. The gunner might have a ballistic reticle on his sight to allow for making use of this range estimate, but that was usually all he had.

(continued on page 13)



A German 88 in an anti-tank role.

To the Germans, the Russian anti-tank defense looked like this: In 1941 there was one anti-tank strongpoint positioned anywhere from three to five kilometers from the front line. In 1942 at the town of Stalingrad there were two to three strongpoints positioned up to eight to twelve kilometers from the front line. By the spring of 1943 the number of strongpoints had increased to as many as four, over the same depth, and by Kursk there were up to six strongpoints positioned as far as thirty or thirty-five kilometers behind the front line. By the end of the war the Germans might encounter as many as eight strongpoints, thirty to fifty kilometers behind the front line. What the enemy tanks would have to do then would be to fight through one strongpoint after another. Because the Russians were very adept at camouflage, the Germans would never know exactly when they were going to reach a strongpoint, and this would usually mean that upon hitting an anti-tank strongpoint at least one or two tanks would be lost immediately. Reducing anti-tank strongpoints could be a very slow procedure and the faster you did it the more tanks it would probably cost you.

Anti-tank guns were most effective when they had time to dig in and camouflage themselves. But even in a meeting engagement they could be quite effective. Taking any cover they could find, they would be able to remain somewhat hidden because of their much smaller size, relative to tanks. And their weapon, in many cases, was equal to the weapon used on the tanks they were fighting. Anti-tank guns were more vulnerable to high explosive and machinegun fire, but you had to find out where they were before you could shoot at them.

After mines and armor-piercing shell, the most frequent tank killer was infantry anti-tank weapons. This was one of the main reasons why tanks have to have a lot of infantry around them, and in fact, one man armed with a rocket-launcher could quite easily knock out one tank. Unfortunately, the man with the rocket-launcher would almost certainly be killed, wounded, or captured in doing this. Although, in a built up area the individual with the rocket-launcher had a much greater chance of making good his escape. For this reason, tanks were often found to be liabilities when fighting in cities. It is usually the case, however, that the tanks come to the infantry and not the other way around. Until 1943, it was a rather risk-free exercise for armored vehicles to overrun infantry. After 1943 (and the wide-spread introduction of effective infantry anti-tank weapons) overrunning infantry became a much more costly undertaking.

During the 1960's reliable and effective anti-tank guided missiles became widely available to most of the world's armed forces. These weapons have recently become even more sophisticated. Their biggest drawbacks to date have been the stand-off distance, that is, the fact that these missiles cannot hit anything within 200 to 500 meters from where they are launched. Their other drawback is the time in flight: since they are relatively slow and you can actually see them coming. This is probably due to the fact that in most of the guided missile systems the missiles are literally guided by the missile operator to the target. Another problem with the missiles is that they use a shaped-charge warhead. Shaped-charge (or HEAT Shell) is not really as effective in practice as

armor-piercing shell. In fact, for infantry HEAT weapons it sometimes takes as many as a half a dozen or more hits to knock out a medium tank. Nevertheless, anti-tank guided missiles are lighter, and thus more portable, than anti-tank guns, and are relatively easier to use than anti-tank guns. Missiles are also rather expensive, costing a few thousand dollars a piece. But then, most modern tanks cost from three to six hundred thousand dollars to manufacture. Even you have to fire ten or twenty missiles to knock out a tank, you are still ahead of the game.

Artillery has never been a very effective weapon against tanks. It is not totally ineffective, but its efficiency against armor is so low that it cannot seriously be considered as a standard anti-tank weapon, except when it is firing pointblank with HEAT Shell. For example, armored vehicles moving through a barrage from guns of 150mm caliber will experience only a one percent loss rate per volley of shells. In practical terms this means that it would take anywhere from one hundred to two hundred artillery shells to knock out a tank assuming the shells can be put in the same area that the tanks are occupying. This is rather difficult to do since the tanks are moving anywhere from ten to twenty-five kilometers an hour.

How do tanks deal with all these problems? The simplest way is to avoid them. In other words, don't run right into the enemy's anti-tank firepower. If this cannot be avoided, the tanks try to take a lot of infantry with them and move slowly and methodically through the enemy defenses. When not allowed this "luxury" the tanks simply have to wade in there and take their licks.

From the Tank Commander's Hatch

The commander of a tank is unique in the military. The tank crew is the smallest ground combat element in the armed forces. The fact that the crewmen literally share a common mission — and a common fate in combat — not to mention the natural bonds that constant proximity create, make tank crews close and their commanders people with unique responsibilities. The need to work as a team is as great, if not greater, than any other ground combat unit. Each man has a unique function in the tank and a failure by anyone makes for failure by the tank. It is, ultimately, the tank commander's duty to make the crew function as a whole.

It is the little things that make fighting in a tank complex. The physical performance of the various duties in a tank are not hard. But the small things add up. Consider, for example, the gunner. He is the man who actually aims the gun and, hopefully, kills the enemy tank. He is ensconced in a small, cramped seat with little room above his head, little room ahead of his knees, one shoulder brushing against the gun and the other against whatever controls (if any) are to the side. The opportunities to shift positions to get comfortable are few. He is limited to what he can see out of his telescopes and periscopes and that is precious little at best. More normally, the gun is aimed at nothing in particular and he can watch small portions of countryside go bouncing past, trying to keep from getting seasick. If he is on his toes, he is searching his sector of responsibility, perhaps twenty degrees of arc in the area where enemy action is most to be expected. But he still can't see much unless a tank should happen to be in that area of search. The net result, unless combat is imminent, is that gunners are usually the best rested of the crewmen because the only alternative is going quietly mad, staring at nothing, is to put your head against the headrest for the sights and go to sleep.

The driver has a more interesting situation because he is quite active most of the time a tank is in use. However, he too has some practical problems. Since he is seated rather far back from the bow and since the tank itself usually has to sit higher off the ground than a conventional car due to ground clearance needs, he has a hard time seeing what lies directly ahead. When moving across country at typical speeds of ten to fifteen miles per hour, it is hard to be sure whether a piece of ground has too many holes to make for an easy ride. So, the tank bottoms out and the tank commander gets bruised ribs from being thrown around in the turret (the steel of a tank turret is probably the most unforgiving metal in the world when it comes to dealing kindly with humans bumping against it). Or the driver might miss realizing that the brook he is about to cross has the wrong type of sides to permit the tank to get back out, resulting in the tank rapidly digging itself into the streambed and having to be

hauled out by another tank or a tank recovery vehicle. All of this adds a burden to a tank commander's duties since he can often ascertain due to his higher location, far more readily than the driver, the traversability of a particular piece of ground over which they are about to go. The commander usually has to alternate between looking ahead to see where the enemy is and what he is doing and looking down to tell the driver to slow down or go right because of something which the driver can't see.

The driver's problems compound when he closes his hatch. His field of vision is now limited to the vision blocks or episcopes, as they are sometimes known, designed to provide some vision for the "buttoned up" driver. Some tanks only have one vision block that rotates, others have a series set around the driver's hatch. All of them produce even more blind spots where the driver has no notion as to what lies there. Further, the combat pressure on a driver is greater than might be the case with other crewmen: he is the fellow who sits right along the normal line of sight for an enemy tank trying a head-on shot; when the turret is facing forward, the driver usually cannot exit through the turret. Some tanks have an escape hatch for the driver, but this is not always suitable for use, with the result that the driver's most common means of exit is out of his own hatch, over the tank's bow — the very point where people are shooting at the tank.

The loader, by tradition, is the junior man on the tank. His job, when not actually loading, is to observe to the rear, with his head out of his hatch. People being what they are, he is usually more interested in looking ahead to see what's coming, thereby leaving that sector often untended. Once inside the turret, loading the main gun, the loader takes on certain attributes of an acrobat. A good loader can have one round ready to go into the tube while the gun is firing the first one. As the spent round comes out, he throws the new one home and ends up dodging the spent round as it bounces around the turret floor, red hot, and seemingly bent on nothing less than bruising his shins, if not burning any carelessly exposed skin. Thus, the loader usually masters the fine art of stamping on the spent round as it bounces off the rear of the turret, thereby bringing it to the turret floor. After a while of doing this, however, there is a thin layer of spent shells on the floor and the loader must negotiate his new main gun round while trying to find footing among this collection of bouncing shells.

As far as that goes, there are other "pleasures" reserved for tank crews. Modern ammunition, large as it is, throws out a lot of gases which come back into the turret when the breach opens to eject the spent round. There is nothing quite like the ammonia smell which fills a turret when something like a HEP round goes off, to clear sinuses and bring tears to one's eyes. There may be a turret blower to clear this out, but usually someone has forgotten to turn it on until after the fumes are all

around. The problem is compounded when the loader has his hatch locked in combat, giving no place for the fumes to go, other than out the commander's hatch.

The commander, by tradition, does not button up his hatch unless under artillery fire or the like. Routine combat situations require that he keep his head and shoulders out of the tank. Although this may not seem like much fun for the commander, when everyone else is buttoned up and relatively safe, the reason is obvious: only the commander is left with free vision as to the situation around the tank. Someone must be able to make this type of observation without being restricted by blind spots so the commander is elected. He also has his own sector of responsibility in making observations and it is usually the tank commander who mans the turret mounted machinegun (originally denominated an anti-aircraft machinegun but now more commonly considered suitable for trucks and personnel). Then, aside from the foregoing, the commander must be sure his tank's actions are properly integrated with the rest of the platoon or company. Tanks may all have radios in this day and age, but they leave something to be desired over actually seeing the situation and reacting accordingly.

With regard to radios, these can further add to the confusion. Since the commander can only have one set of headsets, all radio and tank interphone conversation has to come over that same set. In most tanks the interphone system is set up so all of the crewmembers can actually talk simultaneously (as opposed to the requirement that only one person can talk at a time on the conventional tank radio system). Nonetheless, one could be faced with the three other crewmen talking over the interphone to the commander, the company commander talking to you over one radio (if you are, say, a platoon leader) and one of the tanks in the platoon talking to you over another (in the U.S. Army, for example, a platoon leader has a radio and a receiver so that he can monitor two separate stations simultaneously). The chaos is not merely because of all these conflicting conversations coming across, but sorting out one from another presents its own unique problems.

In charge of all this, trying not only to bring order out of the apparent chaos, but cause his tank to fight effectively, both individually and as part of the unit, is the tank commander. If it appears that at times he takes on the aspects of a ringmaster, the appearance is not altogether incorrect. It is no wonder that, for example, in the U.S. Army a tank commander is, at least nominally, no lower in rank than Staff Sergeant E6 (though, as everyone in service knows, it is not unusual to hold the position at an even more junior grade). Similar rank is held by tank commanders in other armies. The job is a demanding and responsible one for unless he performs his job of holding the crew together and honing into a fighting unit, that tank is of no value in combat.

(continued from page 11)

The Germans did experiment with a stereoscopic rangefinder when they worked on a new turret for the Panther, to be used on an updated tank to be known as Panther II. The tank was never built and the rangefinder remained in prototype. The consequence of this was that as one got beyond 500 meters, the natural laws of physics took over. Naturally, a round falls toward the ground. The

greater the distance traveled, the greater the drop-off from the line of sight. As the range increases, in order to hit a target, the gun tube must be elevated above the line of sight (superelevation). The superelevation must be estimated, if one does not have other means of ensuring proper "lay" of the gun. As a result, at around 1000 yards, tanks virtually had to give up a first round hit (unless the crew were highly skilled) and make a second round adjustment.

STABILIZATION

When a tank moves over the ground, it naturally gives the gun tube a rough ride. Consequently, it is normally impossible to fire on the move (war movies to the contrary, notwithstanding). The solution, adopted by the United States, was gyroscopic stabilization. This permitted the gun tube to remain locked on a given target no matter how much the tank bobbed up and down while moving over the ground. During the war, this major

(continued on page 16)

Putting it all Together or Why Second Platoon Seized the Wrong Objective

Armored operations tend to be spread out over a wide stretch of terrain. Accordingly, the possibility of a company commander hopping back and forth between the various platoons to ensure that they all know what is going on at all times and are doing the best they can to accomplish the mission is greatly reduced. As a practical matter, the company commander must rely heavily on radio communications, both up and down the net. He must count on the platoon leaders giving him accurate and timely reports as to what is going on in their sectors, and he must be able to communicate to his platoon leaders any information needed to permit them to effect their mission. If, for example, one platoon is being held up, the company commander may want to hold back the other platoons so that they don't get too far ahead and present an exposed flank. Or he may want to divert another platoon to assist that first platoon in neutralizing or bypassing the resistance which is detaining them. Unless he knows that that one platoon is being held up, he can't make that decision and unless he can communicate with the other platoons, he cannot execute the decision.

Tank company communications being what they are, often one platoon leader is busy speaking with his platoon at the very moment the company commander is trying to reach him. Depending on how he has his radios set up, he may have had to change frequencies to talk to the platoon so that, momentarily, he is not on the company command net and, accordingly, cannot even learn that the company commander is trying to reach him. More often, the problem lies in the fact that the platoon leader encountering the resistance is so wrapped up in dealing with that problem that he simply forgets to tell the company commander. The company commander may be so positioned that he cannot clearly observe what is going on in that platoon's sector and so it goes.

Tank operations, because of their dispersed nature, also tend to rely more on fragmentary orders, rather than the more detailed and clearly defined orders which might be expected in an infantry unit. The company commander cannot afford the time at every turn, needed to assemble his platoon leaders and then afford them a chance to assemble each of their tank commanders to pass on the word gained from the company commander before they

must execute a new mission. As soon as detailed, face to face briefing is abandoned, no matter how valid the reason, the opportunity for misinterpretation of orders arises. Moreover, when the company commander is briefing the platoon leaders, the mission may be perfectly clear — as shown on the map. But once the fighting gets going and the platoons find that they are not able to neatly advance as the plans originally proposed, problems begin to arise. One of the most common problems is relating the map to the ground and realizing that at some point, for example, you have to alter the direction of advance in order to proceed to the platoon's portion of the company objective. It is no mean feat to keep a map (or as much of it as you can afford to keep exposed while the breeze generated by the movement of the tank keeps the map flapping about) properly oriented to the ground. At some point, as often as not, the platoon leader spots a rise ahead and, based on a hasty glance at the map, determines that this is his goal and away he goes only to find that his and another platoon are getting in each other's way on the same piece of ground while off to his right or left is a clear section which was obviously the place he should have been.

The herd instinct also plays hob with trying to run a company effectively. The subordinate tank commanders, less sure of what they are doing, like to stay close to the platoon leader or platoon sergeant. Adjustment of positions isn't all that hard. You can either use arm and hand signals to indicate that the tanks should spread out (which usually meant that the tank commander being directed acknowledges your direction and proceeds to go off in a direction which is nowhere near the direction you wanted him to take) or you can use the radio (which leads to a lot of "over here?" "No, move over further," "How about now?" and so on, all of which ties up the radio while some poor soul, who is going in the right direction is trying to find some air available for him to break in and tell you about the enemy tank battalion he sees coming over the rise at him).

The reliance placed on radios in all armies has advantages and disadvantages. The advantages are obvious. The disadvantages are that the tanks tend to rely on radio to the extent that the commanders like to broadcast as freely as they talk over their interphone system to the gunner and

driver. The air gets filled with what is often relatively trivial things, preventing more important transmissions from getting the space in which to be broadcast. Should the radios fail, not being in the habit of using arm and hand signals for control, the whole system of control breaks down. All armies plan on using electronic warfare techniques, including jamming of radios. A platoon can usually cope with arm and hand signals if everyone has the presence of mind to realize what is happening and begin looking to the neighboring tanks for signals from the platoon leader. It is harder for a company commander to signal to the platoons this way, but it can be done — usually with a good deal of prior planning. A battalion simply falls apart. Of course, there is usually an alternate frequency available for this contingency, but there is also the traditional 10% who never get the word and remain on the old frequency, wondering where everyone has gone and what they should do next.

While most accounts of armored operations tend to ignore the problem, command control is the hardest element of an armored operation and its success or failure is usually the reason why the whole operation succeeds or fails. If the tank commanders don't really know where they are going, they tend to do what they think is best. It is one of the strong points of tank units that the individual tank commanders are trained (in theory at least) to use a great deal of initiative so that in the event that they cannot maintain visual contact with the platoon, they can still execute their mission. It is, of course, almost impossible to locate individual tanks just by radio. Reporting "I'm over here" does very little unless the man is also waving a flag or something so that you can where "over here" is.

Training and experience working together tends to minimize these problems since the various tank commanders then learn to know what is expected of them in a given situation and can react accordingly (even when not specifically told to) to that certain expected act. But invariable the hardest job a tank company commander has is not in conceiving his company's scheme of maneuver but in exercising sufficient control to ensure that the scheme is executed — for, in Robert Burns' words, "The best laid plans of mice and men gang aft a'glee."

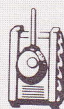
Tactics

Tactics for armor units are generally similar at platoon and company levels among all countries since all tank forces are motivated by similar considerations: control and maximum fire power oriented on the enemy. This produces the following basic formations: a column, a line, a wedge, an echelon right or left and a refused right or left. The diagrams show how these formations are executed in the U.S. Army. The principle, however, is the same regardless of whether a five tank platoon is used or the three tank platoon of the Soviets and others.

These formations interrelate. A column formation brings maximum firepower to the flanks but little to the front; an echelon formation permits strong fire power toward the echeloned flank but limited firepower forward (though more than a column). The line puts maximum firepower forward but limited to the flanks. The wedge permits greater flank firepower than the line without sacrificing the forward firepower capabilities. The refused flank is used as a temporary measure when a given location (such as a small woods) presents a potential, temporary threat. Of these, the column is the easiest to formation to control since everyone moves "follow-the-leader," while the line is the hardest since all tanks are basically moving to suit the situation as they each see it. For a time, in World War II, the Americans used what they called a "diced five" formation, with the tanks arranged like the spots on a die. On the face of it a diced five formation has a lot to recommend it, but in effect, only two tanks can fire on a target at any one time, with the center tank being masked by the other two tanks when firing anyplace other than straight ahead. As a result, that formation has been abandoned and the ones mentioned above are common throughout all armies, with the wedge type formation being the most favored. However, it should be noted that the Soviets do not use a wedge at platoon level — they organize the company into a column of platoons, but the lead tanks in each column are oriented so that, insofar as the enemy is concerned, they can bring to bear the same firepower a wedge would have.

The application of these systems in combat is related to the size of the platoon. The Soviets and British both use three tank platoons while the French, Germans and Americans use five tanks per platoon. Formerly, the U.S. divided their platoons into a light and heavy section of two or three tanks respectively. However, this has been abandoned in recent years as a formal subdivision. On the other hand, in practice platoons will maneuver as if the two sections still existed. The French and Germans, on the other hand, organize their platoons into a headquarters tank and two sections of two tanks each. The mere fact that they are organized this way bespeaks a certain attitude toward committing the tanks and implies that the platoon leader is less an operative and more of a supervisor. In combat it is probable that this will not

COLUMN



ECHELON RIGHT



LINE



WEDGE



REFUSED RIGHT

occur. As organized, the French and German tanks used by the platoon leader would constitute a mini-reserve to bolster whichever section runs into trouble. Thus, among the major powers, the smallest TO&E maneuver element is the French and German two-tank section since the Soviets use all three of their tanks more or less equally on the line and, as noted, the Americans have a basically homogeneous five tank platoon. The British seem to employ tank platoons in pairs giving a practical result that six tanks are a basic maneuver element. The advantage of the larger maneuver element is that one platoon can lay down a base of fire for the other, thereby permitting the non-firing platoon to displace forward to either lay down a base of fire for the rearward element or assault the objective themselves. Fire and maneuver is the key to present tactics since the British are the only major power apparently capable of delivering anything like effective fire while on the move due to gun stabilizers. Since the British have four platoons to a company, they can pair up platoons easily and overcome the limitations of a three tank platoon. The Soviets, however, with a three platoon company, are faced with the fact that if they employ fire and maneuver, no single platoon can employ that tactic by itself and if one platoon is detailed on another mission, there is not an even (or nearly even) balance of elements on each mission.

Integrating the platoon with the company is a different matter. As noted, the Soviets run an austere company with only ten tanks. The French, German and U.S. companies have seventeen tanks, two of the tanks being for the company headquarters (usually one is used by the company commander and the other by the artillery forward observer or someone like that who needs to be up close to the fighting without getting too much exposure). The company commander, in all armies, is very much a supervisor and takes little part in combat. He positions himself to control the maneuvering platoons most effectively, which is usually to the rear of the main company line. Normally, neither a platoon nor a company will keep a reserve. They simply do not have enough tanks to hold back any of their force. Therefore, all platoons are normally up on the line. This has evolved from World War II when it was discovered that the practice of deploying in depth left too many valuable guns out of the fighting, particularly at company level.

Companies use the same basic formations as platoons; wedge, line, column, echelon and refused flank, though, as will be noted later, the addition of a mechanized infantry element will vary this somewhat.

At battalion level, the disparity between the small-platoon nations and the large-platoon nations becomes so great that there is a genuine difference in tactics. The Soviets have only 31 tanks in a battalion as opposed to 54 in the French, German and American battalions. This difference is greater than two Soviet companies. As a

result, while the large battalion powers will usually keep a company in reserve in offensive operations, the Soviets will usually deploy all three companies on line, keeping, at best, a platoon for reserve.

Battalions normally do not use formations as such. The companies are placed abreast and allowed to make their own formations as the tactical situation dictates.

Starting with the Germans, before World War II, the need for infantry-tank integration was recognized, though other powers did not recognize how to do it effectively until they learned the painful lesson of seeing how their enemies did it.

Tanks alone can unleash terrific firepower, but they are vulnerable to close-in attacks. When moving over the ground, it is hard to keep an eye out in every clump of bushes or up in every tree, and enemy personnel willing to risk getting that close to a tank can then bring to bear on the tank their anti-tank weaponry, whether it be a rocket launcher, satchel charge, or Molotov Cocktail. Obviously, there is a risk entailed in trying to get that close to a tank since once such soldiers are spotted by the tank crew, their chances of survival become drastically reduced.

Still, for the one man willing to take the chance of being discovered, the odds of him getting a kill on a tank are high. To expend one man for one tank is a rather cold-blooded way of looking at things, but the fact is that one tank can, if left to its own devices, kill far more than just one man. So the trade-off, in the long run, is a disadvantageous one for the tanks.

Aside from that, mobility is one of the greatest assets of tanks. When they have to ford a stream or pass through woods, they must slow up and bunch up, forfeiting this mobility. The solution is to have infantry handy so that when these situations arise, the infantry can be deployed to take care of screening for the tanks. In addition, tanks, while good ground-gaining weapons, are poor at rooting out stragglers and securing the ground once gained. The presence of friendly infantry, ready to jump out and secure an objective maximizes the strong points of tanks in getting onto the objective and breaking up the main resistance, while also maximizing the infantry strength of being able to physically cover the ground inch by inch, if necessary.

The combination of infantry and armor in one unit, even an ad hoc arrangement as is the common practice, is unique in warfare. While armies might in the past have cavalry and infantry or infantry and archers, each was usually deployed as an integral element, having its own segment of the battlefield. Combined mechanized infantry and armor operations is based on the idea that the two arms will share the same segment of the battlefield to their mutual benefit.

One of the curiosities of combined arms operations is that these ad hoc cross attachments are the usual rule. A brigade or division will have both tank and infantry units, but a regiment or battalion is pure tank or pure infantry. Yet, for combat

purposes, one normally cross-attaches down to company level so that a tank company, for example, may have two tank platoons and a mechanized infantry platoon and a tank battalion will have two tank companies and a mech company. Why these arrangements are not made permanent is hard to say since the current practice is to cross-attach, to some extent, across the board. The curious thing is that there has been no sign of a permanent cross-attachment being given a good trial in any major army since World War II.

Integrating tanks and infantry in combat is more difficult than running a pure unit across the ground, and it is harder in fact than it would seem in theory. Because battalions, for example, are organized as pure units, except on those occasions when there is combined arms training, unit commanders tend to think only of their own particular specialty so that they are very much fish out of water when it comes to effectively employing a combined arms force. [While a tank company commander will know how to do it, in general, the details are usually outside his experience and he must rely on the advice of the infantry platoon leader who may know as little about armor as the company commander knows about infantry, thereby creating a blind leading the blind situation.] Obviously, using both arms to their maximum advantage is the only way to ensure success in a combined arms operation and the mutual lack of familiarity is only eased through extensive training or actual combat employment. The former situation is too often not available and the latter is learning the hard way.

In general terms, one tries to use the fire power, mobility and armor protection of the tanks as much as possible so that they charge over the ground to the objective, permitting the infantry to stay mounted until the last possible moment. Terrain and the tactical situation often require that this ideal situation be abandoned and that the infantry lead the way for the tanks. When the infantry leads the way, it is dismounted and, accordingly, everything is slowed down and the tanks are that much more vulnerable to enemy fire. Taking the ideal situation, the tanks would sweep over the final objective, the infantry would dismount on the final objective, secure it and prepare for any counterattacks, while the tanks would pull back into the objective to consolidate it.

Because cross-attachment means, usually, giving up an element of your own unit to get a like element from your opposite number, formations are modified.

At this point mention should be made of the Soviet system of echelonment. They normally deploy in two echelons, one behind the other. A regiment would have two battalions on line and one forming the second echelon for the regiment. In this sense, it is little different from Western practice. However, in the West if the lead elements achieve a breakthrough, they press on. In the Soviet system the second echelon is used for exploitation of the first echelon's breakthrough.

(continued on page 16)

(continued from page 15)

Defensive operations are less divergent. Normally a defensive operation is integrated on a higher level than an offensive one. For example, while each battalion may have its own offensive objectives, a brigade will control the defense in an entire sector. Normally there are two types of defense — a mobile defense and an area defense. The former has a large, tank-heavy reserve. A mobile defense accepts the fact that the enemy will penetrate the defensive line but assumes that the forces will be able to prevent the penetration from becoming a breakthrough. When the penetration has about run its course, the tank reserve is thrown in to crush the enemy forces. The area defense seeks to defeat the enemy at long range, does not maintain much of a reserve, and is not willing to accept any penetrations of the line. For armored units, when possible, the mobile defense is favored. Terrain may make it impractical to rely on shifting a large reserve rapidly across the line to smash a penetration and thereby force an area defense. However, when a tank sits still, it forfeits one of its major weapons — its mobility. The mobile defense, in effect, converts the key part of the defense into an offensive operation against the penetration, which is where the crucial battle in a defense is expected to take place.

At the platoon level, platoons occupy blocking positions, orienting the individual tanks so that they can bring fire on main areas of access to the defensive position, such as high speed roads and the like. While a platoon in the offensive will generally have each tank fire on targets which present themselves to the individual tanks, and will rarely mass fires on a special target, the reverse is true in the defense. Fires are integrated at the platoon level into an overall fire plan. The tanks not only have primary positions, but supplementary ones to bring fire on secondary targets. Ideally, each blocking position also has an alternate position for each tank from which they can bring fire on their primary targets but to which they can move when things get too hot in their primary positions.

Again, the Soviets use the echelon system. In addition, in arranging their blocking positions within a company, they have the rather unusual alternative practice of putting the central platoon to the rear of the two flank platoons, presumably so that the enemy, seeking to close with the center platoon, will then be more exposed to enfilading fires from the flanking platoons. Normally, troops are closer together in a defensive position than in the offensive and it is not at all uncommon to find the mech company, in a combined arms operation, up on the line with another tank company, rather than in the rear. Similarly, companies will have their mech platoon on the line if the terrain warrants this deployment. In addition, while a reserve is normally not kept at company level, it is not uncommon to have one platoon behind another so as to stiffen the line. The difference between this and a reserve is that this rearward

platoon is in a position from which it can easily integrate its fires with the platoon ahead and it is not expected to shift its position to back up the other platoon, which a reserve force would do. A final note on the defense is the unique system used by the West German Army. They do not defend on the key terrain. They will defend behind the key terrain, leaving thin forces to hold the ground itself. This is a reaction to the Soviet artillery shelling in the war which was so devastating that this tactic was developed as the only means available to avoid being destroyed by artillery. Once the barrage stops, the rearward forces move up to meet the advancing enemy ground forces.

The third type of combat operation is a retrograde operation. Retrograde encompasses delaying operations, withdrawals and retirements. The last is simply a movement away from the front once contact has been broken while a withdrawal involves actually breaking contact. A withdrawal usually leads to a retirement. The delay, on the other hand, is a genuine combat operation in which the delaying force tries to hold onto key terrain for specified periods of time, falling back as needed. A delaying operation does not anticipate holding onto the ground indefinitely, though the fact that a unit is given a mission of holding the ground up to a certain time does not mean that they have to pull off once that time is met.

A delaying operation is similar to a defense in that the units organize blocking positions. A delay is the hardest type of operation to control because there is always the problem of what units to pull out when. If you pull everything off one line and try to move back to the next delay position, the chances are pretty good that you will be pounced on while in transit and take a pounding. The decision is whether to pull out the unit which is least heavily committed or the one which is the most heavily committed. The choice is not easy because if you pull out the least heavily committed unit, the most heavily committed one may be forced to hold off the entire enemy force, while if the most heavily committed unit is pulled back first, the least committed will now find the whole operation dumped on its shoulders. There is no hard and fast rule on this, and it is a command decision of the highest order. Usually battalion and higher units set up delay lines while companies set up a series of blocking positions. Often the blocking positions will not only be set up on the individual delay lines, but also between the lines.

The key to all armored operations is violence of action. The U.S. Army states the mission of armor as being to close with and destroy the enemy by means of firepower, shock action and maneuver in coordination with other arms. While this is merely the U.S. Army way of phrasing it, every major armored power embodies this concept in their armor thinking. Tanks are primarily offensive weapons. Static positions forfeit mobility, which is as important a weapon as firepower.

(continued from page 13)

innovation was not adopted outside the U.S. tanks, though the British were exploring it at the end. As a result, the post-war British tanks had this system while the U.S., curiously, abandoned it.

WEAPONS IN SEARCH OF A ROLE

These factors — the absence of a rangefinder, the use of special anti-tank vehicles, the failure to pursue stabilization — all come from the ambivalent attitude of most countries as to the role of the tanks. If tanks are primarily for the purpose of breaking through infantry, as the Germans originally conceived them, then these elements are unnecessary. However, as the war went on, it became apparent that tanks could do more than just break through and, in fact, were needed in these other roles. If the only thing able to stand up to a tank as an equal is another tank, it follows that one of a tank's primary missions *must* be defeating other tanks. Upgunning tanks was in part a recognition of this fact, albeit tacit recognition. Only the Soviets seem to have bitten the bullet right away. The T34/76 could take on anything the Germans had then and the soon-adopted 85mm gun gave the Soviets a weapon which could defeat anything the Germans were able to field up through the war's end. The whole design of the T34 reflected an awareness of the anti-tank use of a tank. The sloping of the armor, as well as its thickness, all bespoke a vehicle designed to fight both tanks and spearhead breakthroughs.

Inertia is one reason why other nations did not come to grips with this problem as effectively as did the Soviets. Even though they had the world's largest tank force in 1941, the Soviets were defeated. They had to make a radical change and did so. Britain, in the deserts of North Africa, made do with the existing doctrine, modified in light of the French debacle. To change doctrine as radically as the Soviets, required an impetus as radical as the 1941 campaign gave the Soviets. No such impetus appeared. The Allies weren't interested in making changes like when they could make do with what they had. Nor were the Germans. The ultimate goal of German tank development, the superheavy E100 and Maus, was not a response to the threat of the T34. The E100 and Maus were simply mobile fortresses; the T34 was a logical extension of the Blitzkrieg doctrine into the tank versus tank field, having high mobility and high firepower.

POST-WAR TRENDS

After the war, a great deal of thought was devoted to the lessons taught by World War II, insofar as tank usage was concerned. A primary mission of tanks was defeating other tanks. The U.S. abandoned the tank destroyer branch. All armies increased their gun calibres (with some of the changes coming into the picture during the last few months of the war). The U.S. adopted the M26 Pershing, with a 90mm gun. Nominally it was a heavy tank, but in fact it became the forerunner of the current range of U.S. main battle tanks. True heavy tanks were also explored. The British developed the 83.4mm Centurion 3 at the close of the war. The Soviets had gone to the 122mm gun on the JSIII heavy tank, and in 1948 the British brought out their 120mm Conqueror. The U.S. created its first production heavy tank with the M103, also bearing a 120mm gun.

The outcome of this post-war tank development race was a discovery that there were

certain outer limits to tank development if the traditional agility were to be maintained. An artillery piece, relying on the explosive force of the projectile, can have a rather large calibre. But, as noted in the module on tank ammunition, when concerned with firing a slug of metal through a tank, high muzzle velocity becomes important and there are limits to the size of the calibre which can then be carried on a tank. It should not be forgotten, moreover, that increasing the gun calibre means bigger rounds and, accordingly, fewer rounds can be carried in the basic load. On the average, modern tanks carry 20% fewer rounds than their World War II counterparts.

As a result of this discovery on the limits of gun calibre, the standard western calibre, by

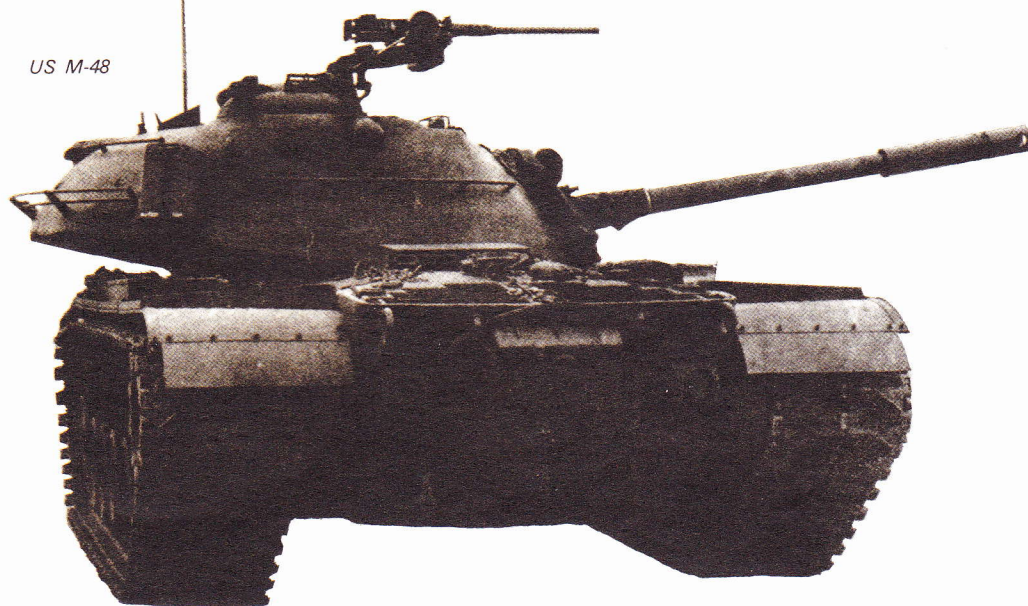
the 1960's, was 105mm (helped largely by the fact that the British 105mm tank gun was probably the finest piece of tank mounted artillery ever developed in terms of accuracy and reliability). The British 105mm was used on the U.S. M60 series, the French AMX 30, the British Vickers MBT (a *privately* produced tank!), the Centurion Mk 13, the German Leopard and the Swiss Pz61. The Soviets had adopted the 100mm gun for their T54 and T55, though the T62 has a 115mm gun (but with a lower muzzle velocity than comparable western 120mm guns).

Since the war there has been a steady decline in the number of light tank-types. Presently, only the Soviet Union has an officially designated light tank in its inventory. Heavy

tanks, too, are apparently passeé. Only Britain and the USSR still employ them. The M103 is to be found in U.S. Marine units, but it is no longer produced and is not in any Army inventory. The Germans have not shown any apparent interest in a heavy tank (nor have the French) though the joint German-American MBT70 project would have given the Germans a 120mm version.

Suspension systems have taken on a similar appearance in post-war tanks. They all have rear drive and large road wheels with all but the Soviets and the Japanese (on their newest tank) using support rollers. In fact, the latest Soviet tank, the T70, appears to have supported track. The major powers all use torsion bars, with the exception of the British,

US M-48



Catering to the Iron Monster

Tanks are demanding mistresses. They require constant care and upkeep and will tolerate abuse only to a point before making strange noises or spewing oil or setting out a cloud of white smoke or simply not running for no apparent reason.

Nations, for obvious reasons, are loathe to reveal shortcomings in their tanks. However, in one of the few publicly reported studies, the United States General Accounting Office did an in-depth study of the M48A2, then the latest thing in the U.S. inventory. Aside from pointing out that Uncle Sam had been taken again, the study showed that the tank broke down about every 35 miles. Since then the veil of secrecy has been drawn back again, but this figure is important since behind it lies the core of the problem with tanks.

To move 30 to 50 tons of tank over open ground at a reasonable speed without shaking the crew to pieces is a unique requirement. No civilian vehicle has a comparable demand placed on it. The balance between ruggedness and essential creature comforts is a surprisingly delicate one. Ask anyone who has operated a

bulldozer for a full day of work how his kidneys feel about the matter.

Beyond that there is the need to "soldier proof" the tank. The ability of the average soldier to break something which is, to all appearances, indestructible, is legendary. When one can break off a gun shield (the metal panel placed next to the breach to prevent careless crewmen from getting a broken elbow due to recoil) he demonstrates incredible ingenuity, not to mention an interesting application of leverage.

The solution to much of this is extensive preventive maintenance. Motor stables, the bane of every tankerman, consume the greatest part of a tank company's time in peace. At the same time, as Hitler found out in 1941, maintenance cannot be neglected in combat. The balance between adequate maintenance and keeping tanks in combat is the commander's eternal headache. U.S. Army technical manuals have page upon page of checklists for before, during and after operations maintenance.

As anyone who has served in the armed forces knows, the detailed directions for such maintenance are more often honored

in the breach than in the observance. Or, to put it another way, the men given the job to do usually prefer to be doing something else and devote much of their time to finding a way to do that something else. Maintaining a tank is hard, unenjoyable work, and it requires constant attention, from the tank commander on up, to ensure that it is properly done.

What usually happens is that the driver starts the tank, revs up the engine and blows an oil cooler. Or the crew decided to skip checking end connectors or track tension and break a track or throw it the first time in the field. Or they don't check the air filters and the engine overheats. And so it goes.

Maintenance is the *sine quae non* of tank operations. It is unquestionably the least dramatic, most time consuming of the many things that go into making tanks run. With tanks becoming more and more complex, the demands of maintenance are even greater. As mentioned, the GAO found the M48A2 broke down about every 35 miles. The chances of beating this figure substantially do not look particularly bright.

who have helical spring suspension (although the Vickers MBT uses torsion bars). The non-major powers seem to be more divergent. The Swedish STRV 103 uses hydropneumatic suspension, the Swiss the Belleville Spring system and the Japanese are working on a hydropneumatic variable suspension, much as the MBT 70 would have had.

One universal change has been the abandonment of the bow gunner. With his limited range of coverage, there is little a bow gunner added to a tank's defense which was not more adequately handled by the gunner using the coaxial machinegun. On the other hand, the

loss of the bow gunner means a loss of one more man for maintenance, which does put a strain on a tank crew.

Main guns now all show a cylinder at various positions on the tube. This is a bore evacuator which clears the gases from the tube and reduces the blast of flame so common when a tank fires. Muzzle brakes, on the other hand, are not to be seen on the more modern tanks. Road wheels are now normally in pairs, independently sprung. The interleaved and overlapping systems of the Panther and Tiger were abandoned, as was the bogie wheel system.

Tracks have become wider in an attempt to reduce ground pressure. The most desirable range for ground pressure is seven pounds per square inch, as this will permit a tank to go about anywhere infantry can. The present range among main battle tanks runs from 10.1 psi, on the Soviet T10M, to 13.3 psi on the Centurion Mk 13, with everything else falling in between.

At the same time, there is a trend toward more lively tanks, rejecting the mobile fortress notion of the Tiger II, Maus and E100 line developed by Germany at the end of the war. This is best reflected in the horsepower per ton

Tracks

Tracks, at first glance, may seem like a subject of monumental disinterest. For some it will be. But tracks are the essence of tanks. Without them, tanks are nothing but immobile pillboxes — instant Maginot Line.

Tracks are the most vulnerable part of a tank, susceptible both to enemy tank fire and mines. They are also an element subject to wear which is the core of this module: the quest for greater track life without forfeiting reliability.

The first tracks were simply made of metal, with a raised tread for traction, held together with a single pin connecting each track block. It was a simple arrangement, such as was, and still is, found on caterpillar-type tractors. From the initiation of tanks through World War II, this was the system used by all major tank powers, except the United States. The dry pin system was easy to maintain but, because the pin fit rather loosely, it permitted grit and the like to work in and cut track life. Typical life was about 1000 miles. This type of track, using a dry pin arrangement to hold the track blocks together, is known as *dead track*.

The U.S. system is generally built on a system known as *live track*. The medium tanks generally have had a double pin track block, with a pin at either end. The two pins are held together with end connectors. The pins themselves are run through rubber bushings in such a way that they do not turn. In fact, they are also inserted so that, when linked together, they tend to curl inward. The advantage of live track is that it assists the drive sprocket in moving the track around. The pins do rotate somewhat in that the rubber bushing permits a torsion effect. The track life of bushed pins is rather variable, running between 1000 miles and as high as 2500 miles, as the Germans expect from the new tracks for the Leopard II. The U.S. also uses a single pin system, especially on the lighter vehicles, such as the armored personnel carriers.

The typical U.S. track has a rubber pad bonded to the outside of the track and another one on the inside. Since roadwheels on U.S. tanks also have a rubber tire bonded to the metal wheels, this means that the tank rolls on rubber and eliminates such problems as wheels freezing to tracks,

encountered by the Germans in the USSR. However, the U.S. system is expensive and generally produces heavier tracks which are harder to maintain in terms of replacing track blocks. It is a good crew that can change one track block in a half an hour.

The reason why both dead and live systems continue to be used is that both have certain advantages. Steel tracks are more reliable in hot, desert climates because rubber tends to blow out. In addition, rocky ground and hard frozen ground favor steel track. By contrast, the rubber pads of live track don't chew up roads as much and afford better traction on hard ice. The fact that most of the Western armies drive on roads in peacetime and civilian populations like to use the same roads militates in favor of the rubber pad. In fact, even though they use dead track, the British and French also have rubber track pads.

The solution being explored is the most obvious: detachable pads. The U.S. will have them on the M60A3. The problem is ensuring that the method of attaching the pads to the track is reliable enough that, with reasonable maintenance, they don't fly off unexpectedly. The bonding system,

in addition, must be at least as reliable as the one currently used to keep the rubber tread on the track blocks.

Concurrent, though not part of the track, is the road wheel system. Initially, all road wheels were steel and rather small. However, it was soon discovered that larger road wheels helped distribute the tank's weight while affording a smoother ride. It is often ignored that a tank is a track *laying* vehicle, which means that it lays down the track in front as it moves and picks it up behind. The tank actually moves on the roadwheels moving over the inside of the track. It is surprising how many people don't realize that a track pad *doesn't move* from the point where it touches the ground until it is picked up after the tank has passed over it.

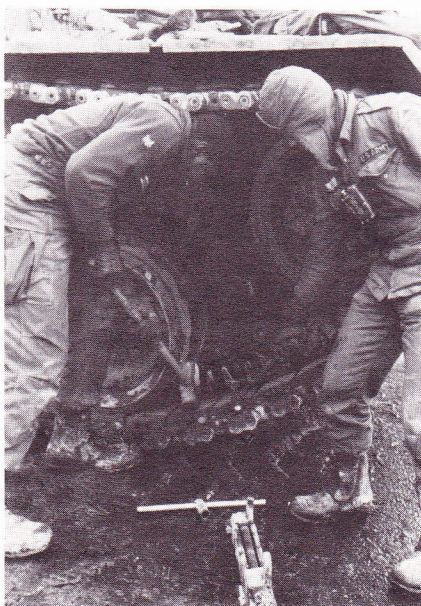
The size of the road wheels is subject to its own limitations. If they are too large and too close together, they trap mud and jam up, eventually causing the tracks to jump off the sprocket. This is one of the reasons why the interleaved system used by the Germans was abandoned.

Rubber tired roadwheels work well when the track is also backed in rubber. When the track is a simple steel track, the wear on the rubber roadwheel tires tend to be considerable, which is one reason why the Germans eventually abandoned rubber tired roadwheels in World War II in favor of steel ones. A compromise is the steel rimmed roadwheel with a rubber insert — a sandwich effect. Thus the wheel presents a metal-on-metal effect when the wheel meets the track, but gives some of the cushioning effect of rubber due to the insert. This system is currently used on the British Conqueror and the Soviet tanks.

The biggest problem plaguing rubber tired roadwheels is blowouts — the rubber separates from the wheel and chunks off. This gives a thumping ride as the torn spot on the wheel makes contact with the tread and beyond a certain point requires replacement of the roadwheel, even though the wheel is structurally sound.

Tracks are a major component of tanks. They are, in fact, one of the weapons available to tanks. Still, they have generally been disregarded in the upgrading of tank components. Only now are ways being explored to extend tracklife to keep up with the rest of the system.

Field repairs being performed on the track of an M-48 (U.S. Army Photo).



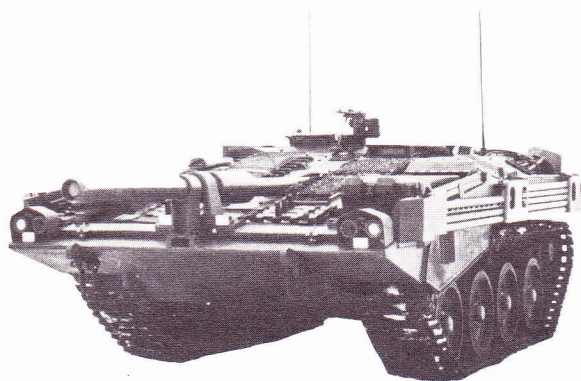
computation. The current range runs from 11.3 for the Centurion Mk 13 to 18.8 for the Leopard. The higher the figure, the more lively the tank. By comparison, the PzKpfw IV rated 12.0, the Tiger II 10.0, the T34/85 15.6, the M4A3E8 Sherman 13.7, the Centurion Mk 1 11.1. The typical modern tank averages about 15.0. In this same area, the diesel engine has uniformly replaced gasoline powered engines.

All tanks have developed some means of ranging, even if only a stadiometric system. In addition, the prospect of night combat appears real enough that all armies have developed an infra-red capability for night tank engagements.

Despite these apparent convergent trends, there still remain some major differences of opinion in tank design. The most obvious is in ranging and fire controls. While all nations have made some steps in this area, there is nothing like unanimity as to the proper solution to the problem. In part this is because the tanks have not been exposed to hard combat to show the strengths and weaknesses of the various systems. Surrogate wars, such as the Arab-Israeli wars, are not a solution since the manufacturers of the tanks generally believe that in the hands of *their* people, different results might be obtained. This must be especially true for the Soviets, in light of the general lack of skill among Arab tankers.

The U.S. solution was an optical rangefinder. Initially, they went to the stereoscopic rangefinder. However, this has an inherent weakness in that many people cannot (physically) use them. The result was the adoption of the coincidence rangefinder which, while requiring practice, is much easier to use. The Germans, in the Leopard, have a method of using both, but conceding the difficulty in using the stereoscopic system, only one crew per platoon is expected to be able to negotiate the stereoscopic system. Its primary value is in hours of limited visibility. The British have retained the ranging machinegun, a cal .50 machinegun mounted coaxially with the main gun. The Soviets use a stadiometric system in the gunner's sights, based on the apparent height of the tank. The Americans use a similar system on the M551 Sheridan based on the apparent width of a tank. The Swedes apparently use a stadiometric reticle also. The Japanese have been using a coincidence system, but with the rangefinder mounted in the tank commander's cupola. Since the accuracy of the system is based on the distance between the two opticals, the Japanese system is not as accurate as the American, which runs the width of the turret. The Swiss and French use a system similar to the U.S.

However, all major tank powers are exploring laser range finders. The Leopard II will have it, as will the U.S. M60A3 as initial issue items. The British Chieftain Mk 5, French AMX 30, and Soviet T62 plan to retrofit lasers. The accuracy this will bring is phenomenal. The British and Soviet tanks, as a practical matter, have a current maximum effective range of around 1000 meters. Nominally, the British ranging machinegun will reach 1825 meters, but sighting tracers in daylight is difficult at best, and beyond 1000 meters, dubious. 1825 meters is the distance where the tracer burns out and beyond that ranging is impossible under the British system. The coincidence and stereoscopic rangefinders can effectively engage targets out to around 2500 meters (and somewhat more with a skilled user) with a



Swedish STRV-103 "S" tank

nominal maximum effective range of from 3500 meters for the French to 4400 meters for the U.S. Laser rangefinders will give an effective range of 8000 meters to the British, which is about as far as one can see from a tank on the ground, assuming no obstacles (at a height of 10' one can see 6730 meters).

The accuracy of a laser rangefinder is reputed to be exceptional. If so (since it has not been tested in routine training, much less combat situations) it will invariably force a rethinking of armor employment. For the first time, a tank can accurately range to targets which may be beyond the range of current ammunition. With the nominal maximum effective range no greater than 4400 meters (and the practical range a good deal less) the question of tracer burn out, much less the killing power of a round beyond that range, has been an irrelevant one. Now it becomes crucial.

THE FUTURE OF ARMOR

The laser, if nothing else, raises the question of tanks of the future, not to mention the future of tanks. Several novel designs have been developed in recent years. The earliest is the Swedish STRV 103 or S-tank. It is turretless, which is not particular novelty in light of the German Sturmgeschutz development. But the tube is mounted virtually on top of the "deck" of the tank. This affords an extremely low profile — 6.24 feet to the highest point on the tank. This is very important. Standard armor tactics encourage making use of terrain for cover — getting behind a hill so that as much of the tank is covered as you need (usually up to the gun; this is known as hull defilade). Obviously, terrain is not too accommodating about ensuring that there is a convenient series of rises in the ground on the route of advance or along the selected defensive line. Thus, the lower the tank, the better.

The Soviets and the French have achieved a lower profile than other major tank powers simply by cramping their crews. They both draw on the shortest 5% of the army for their crews. There are no height restrictions on tankers in the U.S. Army, and since Americans are as tall a nation as any in the tank business, the price to be paid in terms of comfort is reflected in tank height. The British have made an accommodation by putting their driver in a reclining position, thereby permitting a lower hull. Still, anyone who has tried to shoehorn himself into a U.S. tank gunner's seat, or rapped his head on a rangefinder, knows that the U.S. is not profligate with space.

A most promising trend in terms of reducing tank height is the variable suspension system. This was used on the MBT 70 and is being used by the Japanese on their newest STB tank. The tank has an "up" or travel configuration. When needed, however, the entire system collapses so that there is virtually

no ground clearance and the tank's belly is on the ground. Ground clearance is not something which can simply be ignored. It is a rather ludicrous feeling to be bellied up on a large rock and unable to move.

Other, perhaps less dramatic developments, lie in the basic tank design. The British, Soviet, and U.S. tanks are lineal descendants of the World War II tanks. But the STRV 103 is related to nothing in its design. Similarly, the MBT 70 was to have a unique design — no "shot traps" and highly sloped surfaces. The Japanese STB presents a novel turret form, exceptionally squat and rounded. In a more modest vein, the new Leopard II has spaced armor and obliquely sloped armor on its turret, presenting, more or less, a wedge when viewed head on.

The STRV 103 presents another novel consideration. It has two engines. One is a conventional diesel. The other is a gas turbine. The diesel runs the tank at low speeds. The turbine is used to start the tank in cold weather and is cut in at high speeds. It can also move the tank alone. Both engines run on diesel fuel or, if necessary, can run on jet fuel or low grade gasoline. Another innovation is the automatic loader, permitting a three man crew (gunner, driver, and commander). Cutting the crew to three by means of more complicated equipment merely adds to the maintenance problems, and it may well come to pass that tanks will become like airplanes with a maintenance crew and a fighting crew. The gun stabilizer is being returned to U.S. tanks and, if properly debugged, should become a universal adaptation. As it is, a tank must halt to fire if it does not have a stabilizer. Once halted, it is a good target. The British, as noted, and the Soviet T62 currently have stabilization. The M60A1 and Leopard I will have it as a retrofit. The Leopard II, M60A2 and M60A3 will all have it as original equipment.

MISSILES

Only the United States, with the M551 Sheridan and the M60A2, has a long range, vehicular mounted, armor defeating missile. However, the laser rangefinder may well change all of that. As noted in the module on tank ammunition, there are inherent limitations on conventional rounds, which rely on the initial muzzle velocity to reach their target. Moreover, being purely ballistic rounds, they are at the whim of the climatic conditions once the round clears the tube. A missile not only continues to fire its propellant after clearing the tube, but as currently used on the M511 and M60A2, may be controlled to the target with a high degree of accuracy.

With the current range of sighting equipment, a missile is of questionable value. It is almost impossible to control at ranges under 1000 meters while the conventional round used by

the U.S. in the 152mm gun system for shorter ranges is of questionable accuracy beyond 800 meters. This crossover point is the very area where the Soviets have planned to initiate tank engagements. But extend the maximum range to 8000 meters and this two hundred meter crossover point is of little significance. The current U.S. missile system is not the system for use with the laser, in that it has a maximum range of around 3000 meters. But it may well be the right track. At the same time, the laser rangefinder is not the panacea yet. It has not been put through the rigors of being manhandled by the typical tanker in routine training.

Nonetheless, the next five years should see a rethinking of missiles as a tank armament and may result in them being adopted in addition to, or in place of, conventional ammunition. This will, in turn, have an impact on tactics since one can now consider accurate engagement at the limits of visibility.

The tank has been the most controversial major item of equipment in the inventory from its creation. How to use it most effectively and what its real capabilities and limitations are has been debated back and forth for decades with no real solution in sight. Every new infantry anti-tank missile has been heralded as the end for tanks. Now helicopters are claimed to be the nemesis of tanks. As a result, many are now writing off the tank as obsolete. While they concede the value of an armored, tracked artillery piece for direct fire, they cite the following major drawbacks: its size; relatively limited mobility in relation to its size; the maintenance problems caused by its complexity; and its vulnerability to aerial observation and fire. This makes for a continued, lively debate as to the future of tanks.

Regardless of one's opinion of the future of tanks, several things are apparent. Tank designs will undergo significant changes as better ballistic designs are adopted and technological developments brought in. One can expect automatic loaders, laser rangefinders and missiles to be examined by everyone, if not uniformly adopted. Multifuel engines, longer-lived track and increased CBR (chemical, biological, and radiological) protection are more subtle developments to be expected.

As one prejudiced in behalf of armor, it is a personal opinion that the epitaph of tanks has yet to be written. As long as the value of tanks, as re-demonstrated in the latest Arab-Israeli go-around, remains, tanks will be a major item in the inventory.

If history has shown anything, on the other hand, it is that from chariots, through phalanxes to knights to straight cavalry, if a particular mode of warfare is in fact obsolete, it will always outlast its value. The first time eyes are opened is when the enemy, with a new technique, inflicts unbearable losses on your outdated system. In limited wars tanks will remain useful (witness their use in Vietnam, where people said they would have no value at all). Even if, in some future limited war, tanks are badly beaten, it will still take a major ground war, repeating the lesson, to force their abandonment, at least for their present role. That's the pessimistic view.

The tanker's view is that the laser range finder and major design innovations discussed above, will allow tanks to adapt to the future's demands and permit armor to remain, as tankers like to consider it, the combat arm of decision.

OUTGOING MAIL (continued from page 4)

are sometimes actual inaccuracies. We do try to avoid these as much as humanly possible, and to the best of our knowledge they are quite few and far between.

The question of bias is one that falls primarily on the writer. We can best explain the presence of biases in the articles by describing how an article for *S&T* comes to be. The articles for *S&T* are almost exclusively based on the same subject as the material we use for a then current game. In other words, once the feedback indicates that a certain subject should be treated as a game, this same subject is simultaneously treated as an article for *S&T*. At this point Jim Dunnigan occupies a central position, since he is simultaneously the editor of the magazine (thus, he assigns the article and the manner in which it will be done), the head of the R&D department (thus, he either designs the games, or assigns someone to design it) and finally, he is in charge of marketing research. Our marketing research operation is one of the less well-known aspects of SPI's operations. The feedback system is one obvious aspect of our marketing research efforts. But equally important are our efforts in analysing the feedback we receive as well as other marketing data we obtain from various sources. Market research goes hand in hand with research and development. In fact, organizationally, the R&D department of SPI contains a Market Research Division, an Editorial Division (which handles all of the written material) and a Game Development Division as well as a pure Research Division. All of these parts are involved in putting together our "approach" to how an article will be done. Market research indicates what aspects of a particular situation should be covered in the game as closely as possible. But when it comes right down to writing the article, it is our policy to give the writer as much freedom as possible. Anyone in the R&D department who disagrees with something the writer is saying, must back up this disagreement with research. We don't have too many disagreements. But when we do, they are settled by matching one person's research materials against another's.

Incidentally, when we run up against problems in game development, these are usually settled with playtesting. And in some cases, we must use a combination of research material and playtesting to resolve a problem for either the game and/or the article. In other words, if you feel an article is biased, it's usually the writers fault, if indeed it is a fault.

And now, we come back to the "Bill Crandell Show." Those of you who read *S&T* 42 remember that Bill Crandell took vigorous exception to our contacts with the Department of Defense, and in particular, our accepting assignments from Defense Department Agencies or Defense Department suppliers. Bill Crandell's letter, and our response, brought forth 39 letters (as of May Day, 1974) on the subject from subscribers. Most of these letters were quite lengthy. Eleven of them were strongly against any involvement by SPI with the Department of Defense. Nine of these letters were strongly in favor of such cooperation, while twenty were in the middle. That is, they did not try and tell us what to do, they merely offered advice and/or criticism regarding the way Bill Crandell or SPI presented their views. Before we give you our reaction, we think it might be best if we gave you a chance to read what some of your fellow subscribers had to say on this issue. The following excerpts were chosen from the twenty letters that we considered in the middle. This first letter contains elements of many of the 11 anti-Defense-Department-cooperation letters. That is, it pointed out some of the possible problems we might encounter.

If the Army or the Marines or the Alaska Scouts require a certain simulation for the welfare of the U.S.A., you have an obligation to provide it — if you can — without sacrificing your public and private responsibilities. But then let's have no more infantile rationalization about games that are less expensive when Defense money is applied to a particular project, or, "We were working on that game anyway, so all the contact did was speed up our schedule." That is bullshit. Designing games is one thing. Another is accepting outside guidelines and specs. If

you are going to start letting outsiders lay down the ground rules and twist your picture to fit their frame, you'll be every bit the prostitute you deny you want to be. I know, that's not how it will be, you say. But the easy money and Washington ego trips have turned many good heads before. I begin to wonder if you truly know how irreversible this sort of thing really is.

You believe you can avoid all this. Maybe so. I hope so. But there's damn few who have managed it.

Simulations Publications has a good thing going. Think over this thing again before taking the plunge. If you think you've got your head straight...go! Because you can't turn back, ever.

— John Van Devender

These next few letters are responses from military people who took some exception to some of the generalizations Bill Crandell made about them.

I would like to answer Bill Crandell's letter, and later present my views on the subject.

1) To state "You [SPI] are encouraging active military officers to think that they can beat whoever-it-is-to-be-next" is a judgement. It is an unproved generalization that may or may not be true, or both, depending on the persons concerned. To design games for the Pentagon could conceivably have the opposite result. You state "If you [SPI] design a game for the Pentagon that helps convince them that they have the capability you will be partly responsible for every Arab and American killed." However, equally conceivable, a game that SPI creates could convince the Pentagon that such an action is unfeasible for some reason or another, and therefore avert an action which might otherwise have happened. Also, what makes you think that all the Pentagon has to say is that we can "win" in a particular area and they would be authorized to go in there and attack that area?

2) You state "the military sets great store in training and wondrous devices and they would believe that such games relate to the real capacity." This is another generalization which is undoubtedly true sometimes, and false at others, depending on who the individuals were. You go on "yet they have a very limited [how limited is limited?] ability to really [what do you mean by this word?] absorb new information and learn." Again, a generalization that may be true at times and untrue at others. You state "they [the Pentagon] assume that our units are as good as they should be. Every General does." I know a General who doesn't, and I know others who don't. Another generalization.

3) You seem to feel that the Army is in a position of dominance in this country. While the Army has a large presence, it is hardly dominant particularly since the Vietnam War.

To summarize, it seems that the letter is filled with one-sided generalizations that present the author's, I believe, biased viewpoint. It is hardly an analytical study, and such provides little, and has only limited meaning. SPI did a good job in covering the main points he stated in the letter.

My viewpoint. As long as there are two or more countries that have differing viewpoints (not necessarily ideological) there will probably exist armies. As far as I know, there is no way (other than perhaps total submission and even this may not work) that one party can prevent another from starting a war, if it is determined to do so. This is not to say war is inevitable, but that peace, unlike war, cannot exist without the mutual concurrence of the two or more parties. Peace is a political/sociological problem, not a military problem.

In the present world situation, it seems unlikely that the existence or coming into existence of a warlike nation can or will be prevented. As such it seems feasible for one or more nations to maintain an army. The military/sociological problem is how to create a humane army. The primary goal in this matter is to instill in as many members as possible a respect, even while killing them, of their fellow human beings. They must treat friend and foe alike humanely and with respect to their humanity. To isolate the Army from society and let it go its own way is not going to aid in achieving this goal. Rarely will a problem go away by

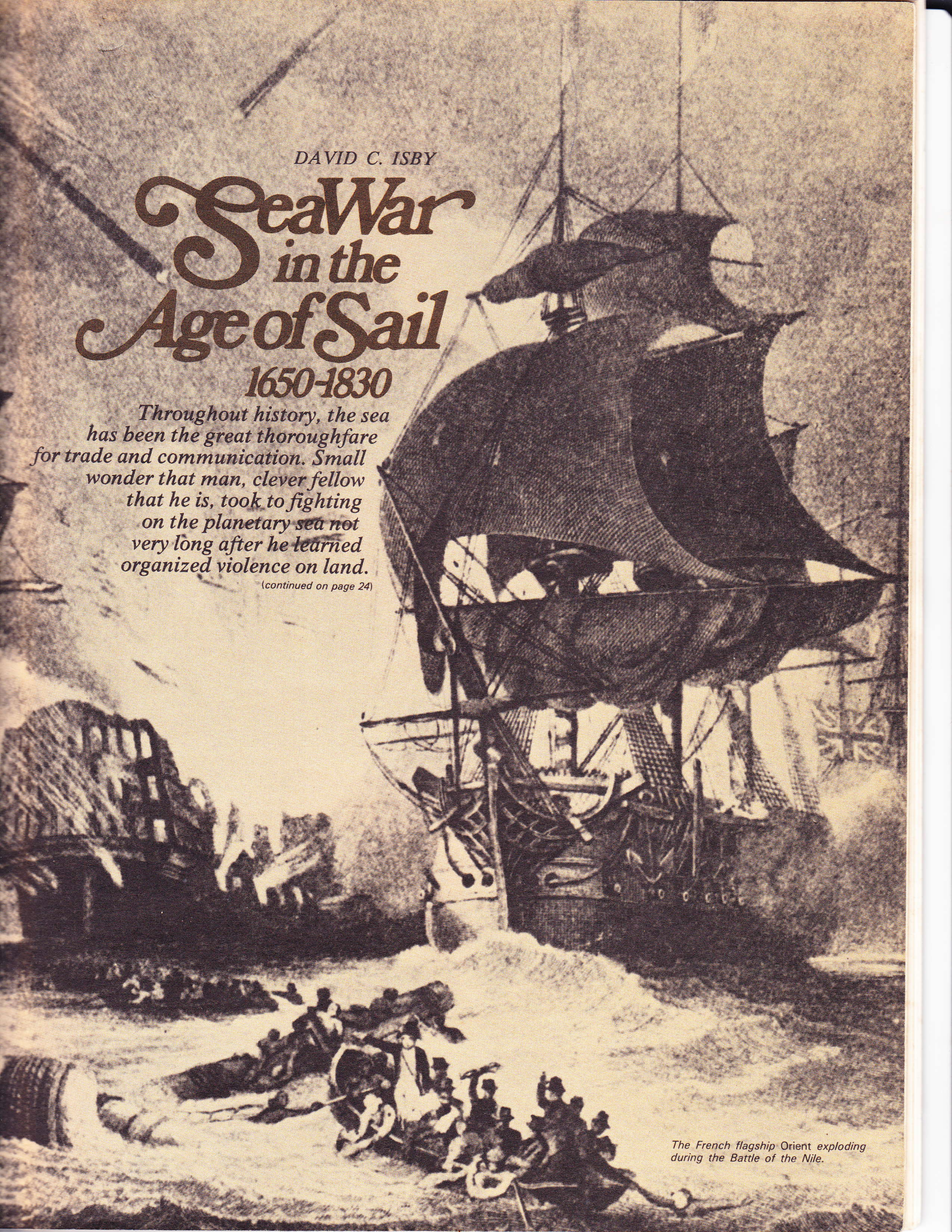
(continued on page 39)

DAVID C. ISBY

SeaWar in the Age of Sail 1650-1830

Throughout history, the sea has been the great thoroughfare for trade and communication. Small wonder that man, clever fellow that he is, took to fighting on the planetary sea not very long after he learned organized violence on land.

(continued on page 24)



The French flagship Orient exploding during the Battle of the Nile.

Seapower and Strategy Under Sail

Designing, building, arming, and manning a navy was one thing. Using it was quite another. Each nation found different answers to the problems of naval strategy in the age of sail.

Among the considerations was the fact that sailing ships were more independent of bases than twentieth century warships. They required no fuel and carried food (of sorts) to last for months.

Because of poor communications (since messages travelled only as fast as the ships carrying them), fleets would often be out of touch with events for months. This made careful planning mandatory, as quick changes could often not be made. Winds, weather, and many other conditions all had to be taken into account when considering strategy.

Strategy and strategic aims proved fairly immutable throughout history, and rarely changed dramatically as governments do. Part of the reason for this constancy is the strong influence geography exerted on naval strategy. The French Navy was forced to divide into two fleets, one in the Atlantic and one in the Mediterranean, which could not support each other, especially since Gibraltar was in British hands after 1704. The Russians, as they have done throughout history, fought for warm-water ports in the north and an exit to the Mediterranean to the south. The Dutch were hindered by their trade having to sail past Britain in order to reach foreign markets. Geographically, Britain had the advantage of being an island, safe from land invasion and able to trade without interference.

Also dictating strategy was economic necessity. The British, Dutch, and to a lesser extent the Danish economies were dependent on trade. These nations had large merchant marines and their economic well-being required the uninterrupted flow of trade. Spain balanced its agrarian economy with trade in valuable material, especially gold and silver, from South America. France possessed almost no maritime trade until the late seventeenth century, but due to internal mismanagement and the depredations of the Royal Navy, France never became a great trading nation.

The desire for trade led to the establishment of colonies. The British, Dutch, French, and Spanish all had colonies they wanted to protect, and this influenced naval strategy. Even more forceful was the urge to acquire new colonies, sometimes for the local inhabitants, but more often from the power who had previously occupied it.

Much of the fighting, in Europe as well as the colonies, was done by the armies. Here proper naval strategy could provide for the transport of troops, bring them supplies (especially vital in the age before railroads) and evacuate them if things got rough. Dunkirk, in 1940, was only the most recent

of a string of evacuations of hard pressed troops by the Royal Navy.

Therefore, the main objectives in naval strategy were: (1) Maintenance of trade, (2) Destruction of enemy commerce, (3) Capturing and holding certain objectives, including colonies, while protecting your own, (4) aiding the army.

Each nation had its own version of how these ideas would be fulfilled. The Spanish, after trying to use the Armada of 1588 as a means to invade England, soon found themselves without any naval strategy, aside from trying, often fruitlessly, to prevent interference with Spanish trade or colonial ambitions. One of the greatest of the Spanish Navy's many failings was its lack of strategic direction.

The Dutch were a trading nation, and centered their naval strategy around trade. They fought to secure the passage of their own merchant ships, as well as trying to destroy those of their trade rivals, the British. Yet the Dutch were also hindered by their government, which often interfered with the Admirals. By 1676, after losing three wars against Britain, the Dutch had declined to a second-rate naval and commercial power. But even in their participation in the Wars of the American and French Revolutions, the Dutch still showed their inclination towards trade defense as a naval strategy.

Perhaps the nation most hindered by the lack of a definite strategy was France. While engaging in commerce raiding with small groups of warships, or individual vessels, the main French fleet would seldom venture from port except to convoy merchantmen into and out of France. When brought to battles, the French continually avoided close action. While this kept losses down, it also prevented the French from using their navy as a decisive weapon, as only in close action could any real damage be done. The only original or daring strategic plans attempted by the French Navy both came from outside the naval hierarchy. The first, by Chosieul, the Minister of Marine in 1759, involved the unification of the Mediterranean and Atlantic fleets, which would unite and seize the English Channel. This was stopped by the British at the Battles of Quiberon and Lagos. The other was by Napoleon Bonaparte, who expected his navy to fulfill his complicated strategies the way his army did. Unfortunately, for the French, the result was the decisive British victory of Trafalgar, in 1805.

The Americans were also dependent on trade, yet in their three conflicts of the age of sail (the War of American Independence, the undeclared war against France in the 1790's, and the War of 1812), they found that their small navy was unable to stop American trade from being stifled. This was accomplished as much by blockading the American's European markets as American ports. In return, the Americans relied on privateers and their few small warships to harass enemy commerce. While they were fairly effective at this, they were generally no more than nuisances to their enemies.

The British entered the age of sail rather lightheartedly. The contented themselves with randomly capturing Spanish shipping and colonies. This "strategy," if one can call it such, was used until the Second Dutch War, when several embarrassing defeats led the British to reconsider. In a process of gradual evolution over the next few decades, the British came up with a solution to the question: what was the best means to obtain seapower and fulfill the four ends of naval strategy. The answer was by destroying the enemy navy. Each of the four ends of naval strategy could be accomplished by destroying the enemy navy or rendering it ineffective, usually by blockading it in port. British commerce could easily be maintained, as there would be no one to interfere with it if the enemy fleet was out of action. Without warships to protect them, enemy commerce would be non-existent. Enemy colonies, cut off from their mother country, would be ripe pickings for the British once the enemy navy was out of the way. The British Army became a "projectile to be fired ashore by the Royal Navy." This forced any enemy to guard against sudden invasions or raids anywhere on the coast. Supplies could be carried to Britain's continental allies. The destruction of the enemy fleet could be accomplished either by blockade or by battle, usually both. In a blockade, with British warships hovering off every port, convoys of merchantmen or fleets of warships would inevitably be caught and brought to action, which is precisely what the British wanted. If they remained in port, the ships would begin to decay and the crews would lose their skills, while the British had free run of the oceans. If a battle resulted, the Royal Navy relied on its superb crews, close action, and aggressive naval tactics.

To enable this classic strategy to work, the British had to rely on diplomacy to keep a balance of power in Europe, find a continental ally to do most of the land fighting, and make sure no great power occupied Holland and Belgium. The only time this failed was in the War of American Independence, and this was by no means the Royal Navy's fault.

The blockading British fleets would stay at sea often for years at a time. Most other navies would only put to sea when there were merchantmen to escort or intercept, or an army to be convoyed. The Royal Navy controlled the seas by occupying them and defeating anyone who dared challenge that occupation.

The British were the ones who found the most "correct" answer to the problems of seapower, as they did to the problems posed by tactics, crews, officers, ships, guns, and many other items. It was the fact that the Royal Navy found the solution to these questions better than anyone else that allowed Britain to gain her magnificent Empire, and use her uninterrupted trade to become the first industrial nation and the world's foremost power for a century of *Pax Britannica*.

The Battles of the Age of Sail

This provides a brief recapitulation of the important decisive and non-decisive actions of the age of sail. Each is in the following format: Name and date of action, winning side's fleet and commander's name. Losses are in parenthesis. c. = captured, s. = sunk, ex. = exploded, w. = wrecked on shore. Fireships are not included in losses as they were ammunition rather than vessels. The number of ships of each strength is shown. Losing side's fleet and commander's name; it's losses in parenthesis. To put the battle in context with the overall situation, refer back to the main text.

THE SPANISH ARMADA BATTLES (20-29 July 1588)

BRITISH (Howard) 17 warships, 12 hired ships, 41 merchant ships, 59 ships, several fireships.

SPANISH (Medina-Sidona) 23 galleons, 21 large merchant ships, 29 merchant ships, 31 ships, 4 oar-powered galleases, armed with 3165 guns, manned by 8,766 sailors, 21,855 soldiers, 2,088 galley slaves, and 180 priests. (1 galleon ex., 1 galleon s.; 3 galleons, 1 ship, 1 gallease, and "several" other ships c.)

FIRST TEXEL BATTLE (31 July 1653)

BRITISH (Monk) 90 ships, several fire ships (2 ships s.)

DUTCH (Tromp) 120 ships, 26 fireships (26 ships s. and ex.)

BATTLE OF LOWESTOFT (13 June 1665)

BRITISH (Duke of York) c. 95 ships (146 c.)

DUTCH (Opdam) c. 108 ships (18 s., w., and ex., 14 c.)

THE FOUR DAYS BATTLE (1-4 June 1666)

DUTCH (de Ruyter) 96 ships (5 s., ex. or c.)

BRITISH (Albemarle and Rupert) (59 ships, reinforced by 3 June by 16 more) (9 s., ex., or c.)

THE ST. JAMES DAY BATTLE

(25 July 1666)

BRITISH (Albemarle) 81 ships, 18 fireships (1 ship ex.)

DUTCH (de Ruyter) 88 ships, 20 fireships (20 ships s., ex., or c.)

BATTLE OF SOLEBAY (28 May 1672)

DUTCH (de Ruyter) 91 ships, 18 fireships (1 ship ex., 160 s., 148 c.)

ANGLO-FRENCH (Duke of York) 101 ships, 21 fireships (2 ships ex., 1 of 100 guns, 2 ships s.)

TEXEL (11 August 1673)

DUTCH (de Ruyter) 55 ships, 27 fireships
ANGLO-FRENCH (Rupert) 81 ships, 19 fireships.

BEACHY HEAD (30 June 1690)

FRENCH (Tourville) 1x110, 1x98, 6x80's, 4x74's, 4x70's, 3x66's, 8x62's, 14x58's, 14x52's, 13x50's, 2x46's, 2x40's, 18xfireships.

ANGLO-DUTCH (Torrington) 1x100, 6x90's, 2x82, 4x74's, 16x70's, 2x68's, 5x64's, 5x60's, 6x50's, 2x48's, 10xfireships (1x70, 1x64 ex., 1x74, 1x60, 1x50 s., 1x48 c.)

THE BATTLE OF BARFLEUR (18-20 May 1692)

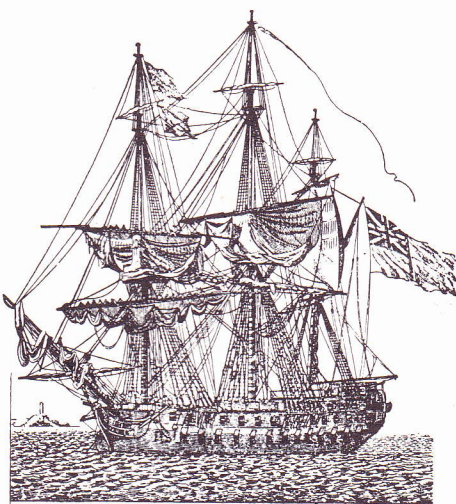
ANGLO-DUTCH (Russell) 6x100's, 9x90's, 3x80's, 1x74's, 23x70's, 7x60's, 1x54, 12x50's, plus 36 Dutch ships.

FRENCH (Tourville) 2x100's, 3x96's, 5x90's, 8x84's, 7x76's, 2x74's, 1x70, 5x68's, 7x64's, 17x60's, 3x58's, 2x54's, 3x50's (12 ships ex. and s., 4 ships c.)

MALAGA (13 August 1704)

ANGLO-DUTCH (rooke) 3x96's, 3x90's, 9x80's, 1x76, 3x72's, 16x70's, 1x66, 6x64's, 4x60's, 1x54, 1x52, 2x50's.

FRANCO-SPANISH (Toulouse) 2x102's, 1x96, 4x92's, 5x88's, 2x84's, 3x74's, 2x70's, 1x68, 2x64's, 17x60's, 7x56's.



The Royal Navy's workhorse: a British 74 gun ship of the line of the 1760-1815 period, when 74's made up the bulk of every navy's battle line.

BATTLE OF CAPE PASSARO

(11 August 1718)

BRITISH (Byng) 1x90, 2x80's, 9x70's, 7x60's, 2x50's, 1x44.

SPANISH (Castenada) 1x74, 1x70, 8x60's, 2x54's, 2x46's, 4x44's, 1x36, 3x30's, 1x24, 1x22, 1x20, 1x18 (1x74, 1x70, 4x60's, 1x54, 1x46, 1x44, 1x26, 1x24 c., 1x46, 1x44 s.)

TOULON (11 February 1744)

BRITISH (Mathews) 3x90's, 8x80's, 1x74, 11x70's, 5x60's

FRANCO-SPANISH (Navarro) 3x110's, 1x84, 4x80's, 10x74's, 2x70's, 5x64's, 3x50's (1x74 c.)

QUIBERON (20 November 1759)

BRITISH (Hawke) 1x100, 3x90's, 7x74's, 5x70's, 3x64's, 5x60's, 4x50's (1x74, 1x64 w.)

FRENCH (Conflans) 4x80's, 5x74's, 2x70's, 8x64's (1x80, 3x74's, 1x70 w., 1x80, 1x74 c.)

THE MOONLIGHT BATTLE

(16 January 1780)

BRITISH (Rodney) 3x90's, 10x74's, 3x70's, 5x64's.

SPANISH (Langara) 1x80, 10x70's (1x70 ex., 1x80, 5x70's c.)

BATTLE OF THE CHESAPEAKE (5 September 1781)

FRENCH (De Grasse) 1x120, 4x84's, 2x80's, 12x74's, 4x64's.

BRITISH (Graves) 2x98's, 8x74's, 1x70, 4x64's, 1x50.

THE BATTLE OF THE SAINTES

(12 April 1782)

BRITISH (Rodney) 5x90's, 20x74's, 1x70, 10x64's.

FRENCH (De Grasse) 1x120, 5x84's, 2x80's, 19x74's, 6x64's (1x120, 1x80, 2x74's, 1x64 c.)

THE GLORIOUS FIRST OF JUNE

(1 June 1794)

BRITISH (Howe) 3x100's, 4x98's, 2x80's, 17x74's.

FRENCH (Villaret-Joyeuse) 1x120, 2x110's, 4x80's, 19x74's (2x80's, 4x74's c., 1x74 ex.)

CAPE ST. VINCENT (14 February 1797)

BRITISH (Jervis) 2x100's, 4x98's, 8x74's, 1x64's, 3x32's.

SPANISH (de Cordova) 1x130, 6x112's, 2x80's, 17x74's, 12x38's/32's/28's (1x80, 1x112 c.)

CAMPERDOWN (11 October 1797)

BRITISH (Duncan) 7x74's, 7x64's, 2x50's, 2x32's.

DUTCH (de Winter) 4x74's, 7x64's, 4x50's, 4x32's/28's (3x74's, 5x64's, 1x50, 2x32's c.)

COPENHAGEN (2 April 1801)

BRITISH (Nelson) 7x74's, 3x64's, 2x50's, 1x38, 2,36's, 1x32, 1x24.

DANISH (Fischer) 1x74, 1x64, 1x62, 1x60, 1x56, 2x48's, 1x26, 1x24, 1x22, 6x20's, 1x18, 1x6 (1x74, 1x64, 1x60, 1x56, 2x48's, 1x26, 1x22, 3x20's, 1x18 c., 2x20's s., 1x62 ex.)

THE BATTLE OF THE NILE (1 August 1798)

BRITISH (Nelson) 13x74's, 1x50.

FRENCH (Brueys) 1x120, 3x80's, 8x74's, 2x40's, 2x36's (3x80's, 8x74's, 2x40's, 1x36 c., 1x120 ex.)

CALDER'S ACTION (22 July 1805)

BRITISH (Calder) 4x98's, 1x80, 8x74's, 2x64's, 2x38's.

FRANCO-SPANISH (Villeneuve) 1x110, 7x80's, 12x74's (1x80, 1x74 c.)

TRAFALGAR (21 October 1805)

BRITISH (Nelson) 3x100's, 4x98's, 1x80, 16x74's, 2x64's, 2x38's, 2x36's.

FRANCO-SPANISH (Villeneuve) 1x130, 2x112's, 1x100, 5x80's, 24x74's, 5x38's. (1x74 ex., 1x130, 1x112, 1x100, 4x80's, 18x74's c.)

NAVARINO (26 October 1827)

ANGLO-FRANCO-RUSSO-GREEK (Codrington, De Rigny, de Heyden, Cochrane) 3x80's, 1x78, 3x76's, 2x74's, 1x50, 2x48's, 4x46's, 1x28, 15 smaller vessels.

TURKS (Ibrahim Pasha) 1x84, 2x74's, 2x64's, 2x60's, 2x50's, 15x48's, 37 smaller ships, 5 fireships, 40 transports (1x48 c., all others except 1x48 and 15 smaller, burnt or scuttled).

Elements of Tactics: Boarding

Although much beloved by Hollywood and novelists, the tactic of coming alongside an enemy ship and boarding it with armed men had been rendered somewhat obsolete by the development of large cannon. The first sign of this shift in emphasis came when the Spanish Armada, whose tactics relied on boarding, was defeated by the gun armed British.

By 1650, boarding was no longer the main weapon of ship-to-ship combat, but it was still an auxiliary weapon. Boarding was often decisive when two ships came to close action and neither could force the other to surrender by using cannon. In that case, one or both captains would order grapples thrown at the other ship, hoping to run afoul. At that time, most of the crew would leave the guns they were manning, grab cutlasses, pistols, muskets, or pikes, and swarm up on deck and, hopefully, over onto the enemy ship. Once a boarding party had gained control of the uppermost deck of an enemy ship, they could close the hatches and keep the rest of the crew below, while the captors would sail the ship away.

After the end of the melee style battle, in the 1670's, boarding became infrequent in fleet actions. The Dutch attempted to practice until the 1690's. The Spanish never really abandoned the idea, and manned their ships with soldiers and the scrapings of the Spanish prisons on the off-chance that there might be a boarding action. Boarding would only occur, after the 1670's, in small or single ship actions. Also, in occasional fleet action situations, usually involving the Spaniards, as at St. Vincent. And with pirates, who had to rely on maneuver and ferocity to overcome their opponents, rather than long drawn out gunnery duels with their merchantmen opponents, which they would be less sure of winning.

One instance where there was a lot of boarding was during "cutting-out." "Cutting-out" was a British specialty of the eighteenth and nineteenth centuries. In this period, the British control of the seas was often complete, and enemy ships would usually keep close to shore, being protected by shore batteries or shallow water. British captains, desirous of getting their hands on such ships, would anchor off the coast and send men in the ship's boats to row to the enemy ship, surprise her, board her, and either set her on fire or sail her out. There were many such actions throughout the Napoleonic Wars. These battles, especially when surprise was lost, turned into bloody hand-to-hand melees on the decks of the boarded ships with the boarders, if beaten, forced back into their boats.

But aside from this and other unusual occasions, boarding was not a valid tactic for most of the Age of Sail.

(continued from page 21)

After many centuries, the Mediterranean civilizations evolved a complex system of naval combat, based on the rowed warship. But with the Dark Ages (500-1200AD), shipping fell into decline, as there was little trade. The High Middle Ages and Renaissance (1200-1500AD), however, brought new interest in the rest of the world. Maritime trade began anew. In Northern Europe, there was the Roundship, a stubby, small sailing vessel with one mast and one triangular sail. Such vessels, carrying valuable goods, were too much of a temptation for many robber barons, who promptly fitted out their own ships to waylay these merchantmen and steal their cargo. So the merchantships began to carry armed men to protect them, and wooden "castles" were built at the bow and stern of each ship.

Occasionally, a Medieval King would feel the need for a fleet. In this case, he would require the local merchants to lease him their ships, which were filled with the King's soldiers. The naval battles, if one can call them such, resembled nautical gang "rumbles." In this manner, the English won the Battle of Dover in 1217 and the battles of Solebay and Espangnol-sur-Mer in the Hundred Years War.

In the more sheltered waters of the Baltic and Mediterranean, however, the oar-powered galley was supreme. In both areas, it would continue in use until the early Nineteenth century. In the Mediterranean, the Spaniards were in contact with the Moors. The Moors had developed a fairly complex system of masts and sails that made sailing more practical. The Spaniards adopted the Moorish caravels and carracks, which were the ships used on many of the great voyages of discovery (1400-1600AD). By the early Sixteenth Century, these voyages resulted in Spain's considerable American Empire. To trade with this Empire, the Spaniards took the Moorish sails and put them on an expanded galley. The result was the *galleon*.

The influence of the galleon spread to Northern Europe, where it was adapted to the traditions of the roundship as well as the Viking longship of the Dark Ages. The British and the Dutch built such ships. These ships were often called galleons, but they were a different type of ship, lighter and faster than the Spanish. As neither the British nor the Dutch had a standing army, they could not protect their ships by filling them with soldiers, as the Spanish did. Instead, they armed their ships with cannon. While firearms had been used as far back as the Fifteenth Century, they had previously been anti-personnel weapons. Battles had been won or lost by boarding or, when using oars, ramming. The British and Dutch, however, put their faith in the new, solid cannon that were being produced.

These northern ships first encountered the Spanish during the Dutch Wars of Independence (1579-1603). To combat the Spanish, the Dutch outfitted many of their ships as privateers. Using their cannon, these ships, known as "sea beggars," were able to cut off Spanish trade with northern Europe.

In 1588, King Phillip of Spain, enraged by British support of the Dutch and British privateers raiding Spanish colonies and disrupting trade, decided to use his fleet, or Armada, to transport the Spanish Army and Inquisition to Britain and bring an end to this menace once and for all. The Armada was the first fleet of three masted fighting ships. The

backbone of this fleet was the Spanish galleons, of adventure story fame. While they relied on boarding as their main tactic, the Spanish, as did their British enemies, often mounted a tier of heavy guns along the side of the ship. This was the first use of the gun-deck. By the early Eighteenth century, the biggest ships would carry three such tiers. After received French and Papal blessings and several false starts, the Armada arrived off England in July 1588.

In a long, running fight up the Channel, lasting several days, the Spanish found that fast, light ships carrying guns could stand off and pound the clumsy galleons and even more unwieldy oar-powered galleys and galleasses, which could not come to grips and board. The Spanish carried guns as well, but these were too light to be effective. By the time the Armada had fired off most of its ammunition, it had not damaged any British ships and had killed but two dozen men. The British guns were not that much better, but they still did considerable damage, resulting in the sinking or capture of many Spanish ships. The Spanish gave up their invasion attempt, but two-thirds of the Armada was wrecked in a storm while returning to Spain. While tactically indecisive, Britain remained uninvaded and the Spanish Navy never recovered from the defeat. Ships, gunnery, the superior skill and leadership of the British had given them victory. Tactics, however, showed little cohesion on either side. Each ship fought as her captain thought best. Many of the ships in both fleets were merchantmen, chartered to function as warships for the battle.

THE BIRTH OF THE WARSHIP, 1588-1750

The final distinction between merchantmen and warships came only in the early Seventeenth century, with the rise of permanent standing navies. The warship-merchantmen distinction was never too sharply drawn throughout the age of sail. As late as 1815, merchant ships trading with India carried 36 guns, the same armament as many frigates. Along with the organization of the navies, there were changes in the design and construction of the ships, which was in part due to the greater specialization now possible.

By 1650, the sail warship had arrived at the point where it would stay for the next hundred and seventy years. Further improvements were in increases of armament, crew, sails, rigging, and hull design, but these were all comparatively minor.

The ship that had evolved by 1650 was the line-of-battle-ship, more usually known as a ship of the line. As its name implies, these ships were to fight in a line of battle, directly opposing similar enemy vessels. These ships of the line were the main instrument of naval combat, fulfilling the role of the dreadnought in the First World War or the aircraft carrier in the Second World War. Originally ships down to twenty guns were put in the line of battle and thus might be considered ships of the line. Ships of the line were usually armed with between 50 and 120 guns, although the lower limit was raised to 64 guns in the mid-eighteenth century. When it came to decisive combat, the ships of the line were all that mattered.

While ships were designated by their types — ships of the line, frigates, sloops, brigs, and smaller craft — this differentiation was often not clear-cut until the mid-eighteenth century. Therefore, the usual way to "rate" ships was

by the number of guns carried. The largest ships of the line would be 100's, or rarely, 120's. More often, ships of the line would be 74's or 64's. Ships were also differentiated by the number of tiers of guns they carried, not counting the topmost deck. Therefore, a 100 gun ship, which carried three tiers of guns, would also be known as a "three-decker." Ships of the line armed with between 84 and 60 guns carried them on two decks, and were thus known as "two-deckers." All frigates and smaller ships had but one gun deck. Also having but one gun deck were "razees," two-deck ships of the line which had had their upper gun deck cut away, thus reducing the armament, lightening the ship, and making it faster. Razees were in general very powerful frigate sized ships.

Ships were also categorized as first rates, second rates, and so on. The categories changed as ship design evolved. In the early seventeenth century, first rate ships carried between 44 and 60 guns. Second rate ships, which greatly outnumbered the first rates, carried 44 to 34 guns. Third rates carried 34 to 26 guns. Fourth rates were anything smaller. There was no differentiation as to type. All ships were nominal ships of the line, although many were less powerful than later frigates.

By the mid-eighteenth century, a more complex rating system had been drawn up. First rates were ships of the line which carried 100 or more guns. Only slightly smaller were the second rates of 90 or more. Both these rates were three-deckers. The real workhorses were the two-deckers of the third rate, 84 to 60 guns. The fourth rates, 60 to 40 guns, contained the hybrids, weak ships of the line and oversized frigates. Most frigates were Fifth rate, 40 to 20 guns. Sloops and brigs and other ships of less than 20 guns were sixth rate.

The rigging of warships and their system of sails was refined throughout the age of sail. From the single-masted roundship of the Middle Ages, with its one triangular sail, evolved the early three-masted ship, such as the galleon. Each mast, originally, carried one large and one small sail. By mid-sixteenth century, it was found more efficient to have three, later increased to four, moderately sized sails on each mast, instead of a few huge ones. There was also the jib in the bow and the spanker in the stern, and sails could be set between these and the masts. Many ships carried the old, medieval, triangular, lanteen sail especially on their mizzenmast and jib, until the early eighteenth century, when it was replaced by more efficient square sails. Almost all warships carried three masts and were square-rigged (used square or rectangular sails) except for the jib and spanker. A fourth mast was tried in the early seventeenth century but was discarded as adding little to propulsive power while helping to make the ship top-heavy.

When the Age of Sail began in earnest with the First Dutch War in 1652, the sail fighting ship and the navies that would use them had emerged, albeit embryonically, in the form they would have until the mid-nineteenth century.

THE FIRST DUTCH WAR (1652-53)

The Cromwellian Commonwealth, in 1650, passed the Navigation Acts, which were intended to cut down Dutch competition with British trade. This, as one might expect, resulted in war. The British won the first battle, off Dover on 19 May 1652, and repeated the feat at the Battle of the Kentish Knock, later

that year. The Dutch, however, came back for a victory at Dungeness. This led the British to rethink their ideas.

Both sides made use of merchant ships in the naval battles. The British, however, found theirs less well armed and less reliable than the Dutch. This contributed greatly to the unwieldiness of the two fleets, as both sides would often use eighty to a hundred ships in one battle. There was little in the way of direction or formation, except that the Dutch would divide their ships into three "battles," a van, main body, and rear. The British were more haphazard. The Dutch had several good Admirals in De Ruyter, Tromp and De Witte. The British had no Admirals, but rather "Generals-at-Sea," such as Monk, Blake, and Penn. All, nonetheless, good commanders. The Dutch strategy revolved around protecting Dutch trade, the British strategy, of interrupting it, as they did in a running battle up the Channel in February 1653.

These early actions were "melee" type battles, no different from the medieval floating brawl or the Armada battles of 1588. The melee resulted in close action, often including ramming and boarding. The attacker in a melee style battle had to have the wind with him, or he would be unable to close with the enemy, as happened to the Spanish in 1588, when the British had the advantage of the wind and refused close action. Most fleets geared for melee tactics went around in a formationless mass, except for the Dutch who had perfected the melee technique and formed three lines abreast. An Admiral commanding a melee battle had almost no command control, as the battle soon degenerated into as many separate actions as there were ships involved. Most of the proponents of the melee battles were men who started their careers ashore, as soldiers, and liked the close-in fighting.

The real innovation of this period, however, was the introduction of the "line-ahead" formation by the British, an organized column of ships. These new tactics were first used during the First Texel Battle. First Texel was the decisive battle of the First Dutch War. This was because the British had invented the line-astern formation, which made command and maneuver easier. They attacked in several parallel columns against the Dutch in their usual three "battles," each of a mass of ships in rough line abreast. The more agile British formation enabled the British to cut the Dutch apart in detail, Tromp being killed in action. Both sides made much use of fireships. For reasons which must remain obscure, the British took no prizes, burning many ships after rescuing their crews. A decisive action, which ended the First Dutch War, made possible by tactical innovation.

THE SECOND DUTCH WAR (1665-67)

The First Dutch War, however, did not resolve the underlying causes of Anglo-Dutch conflict. The British desire to limit the Dutch near-monopoly of European trade did not change, especially when the Commonwealth Navy and its Generals-at-Sea was transformed back into the Royal Navy, commanded by Admirals, when the British monarchy was restored. Strategic goals have proved, throughout history, to be immutable by political change.

The war began with British attempts to seize Dutch colonies world wide, but the decisive theater was, as before, in the North Sea.

The opposing fleets first clashed off Lowestoft. The British, commanded by the Duke of York (later to become King James II) tried to use the line-ahead formations of the previous Dutch War. The large, unwieldy British fleet, however, soon lost any semblance of order. The line-ahead degenerated into a straggling mob and the battle became a melee, a glorified version of the Medieval free-for-alls. Ships roamed in all directions, usually attacking any enemy without a thought for strategy or tactics. At this battle, superior British ships and gunnery enabled the British to defeat the Dutch. The Duke, however, had such little command control over his fleet that he could not order a pursuit. The Dutch withdrew, their Admiral complaining that Dutch politicians safe ashore had ordered him to fight. The Duke of York, despite his victory (and title) was relieved of command.

In early June 1665, the Dutch tried to run a huge convoy down the English Channel. The

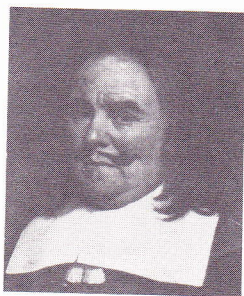
(continued on page 28)

The Wind and Tactics

As sailing ships could only sail when the wind was in a favorable position, one of the primary tactical imperatives of the period was "gaining the weather gauge." This meant having the wind behind one's fleet, enabling it to reach or run down on the enemy who could not turn into the wind to engage. It was a British practice always to gain the weather-gauge and attack the enemy. Having the wind gave the British the advantage of engaging at their option. The initiative was theirs. It enabled them to concentrate their forces against a portion of the enemy's line, if they so desired. The wind would also blow the cannon's smoke away from the British and into the eyes of their enemy, no small advantage in the days before smokeless powder. As for disadvantages, it was difficult to retreat once engaged from upwind. One would have to break clean through the enemy line to escape a battle which had turned against the upwind fleet.

While mindful of the advantages of the upwind position, some navies, most notably the French, preferred to remain downwind, and let the enemy attack them. This was because the downwind position gave an excellent position to withdraw, by just turning away from the enemy fleet. As the French seldom wanted pitched battles, this suited them. The downwind fleet also had the opportunity to fire at the bows of the attacking fleet as they approached, unable to fire back with their full broadsides. The French would usually fire high at their attackers during the approach, damaging their sails, masts and rigging, slowing them down further, and when the attackers would get close, the French would haul out of line and run with the wind, relying on their fast, well-constructed ships to keep out of harm's way. On occasion, however, the attackers would catch up with the fleeing enemy, as the British did at Cape Finisterre, Quiberon, Lagos, and Rodney's "Moonlight Battle." The French rear would invariably get chewed up, with scant loss to the British.

Dramatis Personae



MICHAEL ADRIAN DE RUYTER
(Du., d. 1676)

The greatest of all the Dutch admirals. While his concepts of naval strategy seem to have been limited to trade protection, he dealt the British some painful defeats in all three Dutch Wars. He was aided in this by able subordinates, including the Tromps, father and son; Jan Van Evertsen; and Witte de With. His captains, however, were usually faint-hearted political appointees. De Ruyter used the line-abreast formation to keep his large fleets together. He raided the Thames Estuary and swept the Channel of British ships following the "Four Day's Battle," during his high-point of the Second Dutch War. But the British soon rallied and defeated him at North Foreland. He later fought the French in the Mediterranean and was killed there in 1676. His death marked the eclipse of the Netherlands as a major naval power.

SAMUEL PEPYS (Br., 1633-1703)

The well-known diarist exemplifies a very rare commodity during the period involved; an efficient, uncorrupt, reforming landsman who competently administered naval forces. He personally enacted many reforms that not only helped the British come back from some humiliating defeats and vanquish the Dutch, but also laid the groundwork for the workings of the Royal Navy for the next three centuries.



GEORGE ROOKE (Br., 1650-1709)

A competent First Sea Lord and a theoretical tactician, Rooke first commanded in action when he assisted in the destruction of the French fleet after Barfleur. In 1704, however, he was faced with attacking a Franco-Spanish fleet attempting to blockade Gibraltar. He employed his own theoretical tactics, formulated from behind his desk in London, to drive the Franco-Spanish away in an indecisive action. Rooke, however, was so

delighted by this that he rewrote his theories as the "Fighting Instructions" which was to fossilize naval tactics for seventy-eight years. An excellent theorist and administrator, Rooke was an indifferent tactician.

JOHN BYNG (Br., 1704-1757)

A notably mediocre admiral, Byng was sent with a small, outdated (his flagship was 112 years old) squadron to defend Minorca. He slavishly followed the "Fighting Instructions," even giving up a numerical superiority to do so. Not unexpectedly, he lost and was promptly made a scapegoat for the failings of all concerned. He was court-martialed and shot to "encourage the others."



PIERRE DE ST. TROPEZ ET SUFFREN
(Fr., 1728-1787)

An independent commander, Suffren introduced daring, non-standard tactics into the French Navy. However, his captains and crews were not up to his high standards. Nevertheless, he managed to inflict several defeats upon the British in the East Indies during the American Revolution. Yet he was unable to reform the French Navy and did not change the lack of direction and general sense of decay which prevented that navy from fulfilling the potential created by their occasionally brilliant Admirals and excellent ships.

GEORGE, LORD RODNEY (Br., 1719-1792)

Rodney was the first to overthrow the decaying, overly formal linear system of tactics and the fossilized "Fighting Instructions." His first action of the War of American Independence, the "Moonlight Battle," was confused and the enemy fled before being destroyed. At Martinique, in 1780, he still used the linear formation but massed all his ships against the rear half of the French line. The French, although beaten, escaped total defeat due to a misunderstanding of the complicated signals involved. At the Battle of the Saintes, however, he abandoned the linear formation and plunged into the French fleet to demolish them at close range, totally smashing De Grasse's force. This set a precedent for the new, more decisive and mobile British tactics that were to play such a part in the Wars of 1793-1815. An excellent tactical innovator.

PIERRE DE VILLENEUVE (Fr., d. 1806)

An aristocratic Frenchman, Villeneuve was only in part responsible for the abortive French strategy preceding Trafalgar, as he had to obey Napoleon's whims. He was

also goaded to sea by Napoleon's demands for action and threats to remove him. At Trafalgar, his dispositions were not bad, but he was much too passive and very cooperatively held still while Nelson destroyed his fleet in detail. Captured at Trafalgar, he was exchanged in 1806 and was soon found dead in France with three knife wounds in the heart. It was ruled a suicide.



HORATIO NELSON (Br., 1769-1805)

In all probability, the greatest Admiral in history. His squadron kept control of the Gulf of Lyon from 1793-97, defeating the French several times. In 1797 he helped Sir John Jervis defeat the Spaniards off Cape Vincent by breaking the line of battle. He personally boarded and captured two Spanish ships-of-the-line. In 1798 he attacked and destroyed the French Mediterranean fleet in the Battle of the Nile, again showing great tactical skill. In 1801 (by which time he had lost an arm and an eye, but had gained one Emma Hamilton), he destroyed the Danish fleet in Copenhagen. In 1805, after a long chase, he brought the French and Spaniards to battle off Cape Trafalgar. In a revolutionary plan, he broke the Franco-Spanish line in several places and decisively defeated them. Nelson was shot and died at the moment of his greatest victory, which gave Britain undisputed control of the seas for over a century.

THE BAND OF BROTHERS (Br.)

The "Band of Brothers" was the name given to the captains who served under Nelson from 1797 to Trafalgar. These men were the cream of the British Navy's Captains, which were usually of a very high standard, but in 1793-1815 were better than ever. So these men represented the *creme de la creme*. Their professional understanding and competence, set off by Nelson's brilliance, led to their almost intuitive following of Nelson's complex plans at the Nile, Copenhagen, and Trafalgar. The skill of these men and the genius of Nelson together circumvented the problems caused by signalling.

HORATIO HORNBLLOWER (Br., 1776-1857)

One of the finest Captains of the period in any navy, Hornblower was victorious in many single-ship and small actions. His tactics epitomized the best in British seamanship. He never commanded at any large battle, however. The fact that he was a fictional character should not detract from Hornblower's stature.

The Thunder of the Captains

The solution to tactical and communications problems lay not with machines, but with men. In particular, the men who commanded the ships. During the age of sail, navies rose and fell depending on the skill of their Captains. Admirals could come and go. They were that small in number that good ones could be quickly promoted and bad ones swiftly sacked. However, when one is talking about a navy's captains, one is talking of a body of several hundred men, which doubtlessly will contain at any given time, both men of brilliance and dullards. Yet in any navy, one could discern a norm in which the vast majority of the captains fitted. They were a navy's real strength. A competent group of captains could redeem a bad admiral's bungling by their own actions or make a good admiral's plans even more successful. Yet the best of admirals could not win decisive victories if he had to fight against a bunch of cowardly, slow-witted Captains in his own fleet as well as the enemy.

One of the reasons the Royal Navy, even in its frequent periods of decline, was able to remain successful in naval combat was that the British captains were among the world's finest. Although many of them got their posts through political or family connections, almost all took their jobs very seriously. The promotion and education of British naval officers had been regulated since Pepys' reforms in the 1660's, and bad officers would not rise to high rank unless they had many friends in high places. The Royal Navy was always sure to have

more Captains than it had ships. Those without a command, talent, or connections were beached at half-pay. The Captains of the Royal Navy constituted a thoroughly professional force, and that is one of the chief reasons that during the years 1650-1830, the Royal Navy was sometimes thrashed and embarrassed, but never decisively defeated. The Captains would bail out the poor Admirals, at least preventing such men from destroying their own fleet. Inspired by great men, such as Nelson, they evolved into the "Band of Brothers," the elite of this already remarkable group.

Other nations were not so fortunate. The Dutch found that their best seamen gravitated towards the merchant marine, and their naval officers were largely political appointees. Their efficiency was not increased by the Dutch practice of assigning political commissars to each ship, especially in the Seventeenth Century. These men could not fulfill the potential offered by their often brilliant Admirals.

The French Captains were, before the Revolution, an aristocratic but professional lot. While they would often fight well, they needed to be watched carefully or else they would wander off, or quickly withdraw, as they did at Barfleur in 1692 and throughout the Eighteenth Century. They were not helped by the gross incompetence which usually reigned in the French Naval staff or the lack of a coherent naval strategy. When an excellent French Admiral, such as Suffren or Tourville, did appear, he often found his Captains were not equal to his tactical skill. The incompetence of French Captains robbed them of many victories.

The French Revolution brought an immediate lowering of standards, as most naval officers were either guillotined, fled abroad, or resigned. The resulting crop of Captains were almost totally appointed for their politics, and were even more incapable than the pre-Revolution group. The emergence of Napoleon led to a weeding out of the more incompetent Captains (those that were not in British hands) and he reappointed some of the surviving pre-Revolution Captains. This combination of the better men thrust forward by the Revolution coupled with the leavening of the old navy might have been a formidable combination. However, after the defeat at Trafalgar, the French were bottled up and had no chance to train, thus losing the last opportunity the French had in the age of sail to build up a reserve of skilled captains and officers, a failing which had handicapped them since 1660.

The Americans produced some excellent Captains, especially the Frigate commanders in the war of 1812, but they never had to fight in fleet action. Whether the initiative and skill they displayed in individual actions would have been evidenced in a fleet action is problematical.

The Danes had a small, professional cadre of officers fleshed out by merchant sailors in case of war. The Russians supplemented their own small reserves of officers by hiring foreigners. Some, like John Paul Jones, were quite good. Others were not. The Spanish Captains were selected almost solely on the grounds of their social status, and this hindered the Spanish Navy. Throughout the Age of Sail, it was not the ships, but the men in them, that won battles.

The Communications Gap

In the early days of naval warfare under sail, a fleet might have a pre-arranged plan of battle, but once an action began there was no way orders could be communicated. This became a very real drawback by 1650, when new weapons and tactics had made naval fighting more complex. Therefore, a means had to be developed for the commanding Admiral to communicate his instructions.

The first attempts at this involved the firing of signal guns which was ineffective in battle, with many guns going off in all directions. This led to the invention of the signal flag. The signal flag, while primitive, permitted the Admiral more flexibility. With the flagship in the middle of a line-astern formation, as invented by the British in 1653, or in the middle or right of a line-abreast formation, as used by other nations, other ships could look at whatever flag was flying on the flagship and act

accordingly. This was one of the great advantages of the line-astern formation, as the signals could be seen easily. Yet there was no effective code for signal flags until 1782. This was further refined by 1805 when signalling was as efficient as it could be without the use of radio.

Unfortunately, even the most efficient set of flag signals can very easily be obscured in the smoke of battle, which, during the age of sail, covered ships with dark clouds from the black powder used in the guns. Often an Admiral could hardly see what was happening on his own ship, let alone take in the whole situation.

There were many different attempts to rectify this problem throughout the Age of Sail. There were attempts at doctrinal solutions. This entailed setting up a definite plan of action before the battle that could be followed without regards to communications. This, however, relied upon the skill of the Captains who had to execute these

plans, which was often not up to par. The British, whose Captains were intelligent enough to comprehend most plans, hindered themselves by using the "Fighting Instructions" as their doctrine. After the "Fighting Instructions" had been laid to rest, Admirals such as Nelson were able to merge new advances in signalling with their pre-arranged plans, secure in the knowledge that their captains were intelligent enough to understand them. This enabled Nelson and his contemporaries to use innovative tactics.

There were also technological attempts to get around the communications gap. This included improving flag codes and stationing frigates outside the line of battle to repeat signals, as such ships would not be shrouded in smoke. Such a relay of messages, however, usually took too long to be effective. Technology during the age of sail was too limited to provide a solution to the communications gap that definitely existed.

(continued from page 25)

Royal Navy, naturally, attempted to intercept it. The result was the Four Days Battle, the high water mark of Dutch naval power. Both the British Admirals were soldiers by trade, and they liked nothing better than a close fight. The battle resulted in a series of melees where the Dutch line abreast formation gave them victory over the disorganized British.

As a result of this battle, De Ruyter's Dutch were able to raid the Thames, burning ships within sight of London. The British, however, were not idle. Samuel Pepys, an efficient administrator, was returned to the Admiralty. The melee battle was, temporarily, abandoned. Most important, it was at this time that the British began to develop their ultimate naval strategy, that the object of a navy is to destroy the enemy navy.

The Dutch found out just how quickly the British had learned at the St. James Day battle. Here the British re-introduced the line-astern formation that the Duke of Albemarle (formerly General-at-Sea Monk) invented back in 1652. The Dutch stuck to the line abreast formation, and attempted to close with the British and board. They were badly mauled, however, when Albemarle concentrated the majority of his fleet against the Dutch van. Like most of the other battles of the Dutch War, fireships played an important role. The St. James Day battle showed what possibilities might be gained by massing most of a fleet against part of the enemy's fleet.

Throughout the Dutch Wars, both sides used large fleets, often so large as to be unworkable. The Dutch still relied on melee battles and boarding, when possible. The fleets on both sides were fleshed out by merchant ships. While British gunnery was better, there was little to choose between the two sides in seamanship. British ships were bigger, better armed, and less flammable than the Dutch.

THE THIRD DUTCH WAR (1672-74)

While the British and Dutch hammered each other, the France of Louis XIV built up a navy almost from scratch. By the exertions of Louis' able Navy Minister, Colbert, the French had a fine fleet by 1672. In that year, Louis cajoled Charles II of England into the unpopular Third Dutch War.

The Duke of York, no longer beached, attempted to fight a formal, linear battle against the Dutch when he encountered them off Solebay. The Duke intended for the large Anglo-French fleet to advance in line abreast until they were close to the Dutch fleet. Then they would change into line astern. The battle was among the first envisioned as a duel of lines. Unfortunately for the Duke, neither his French allies nor his Dutch enemies, commanded by the able De Ruyter, cooperated. The French, not wanting to get their bright new ships damaged, stayed out of the fighting. The Dutch did not hold still and massed against the British center. Once again, as at Lowestoft, James lost control of things and a melee resulted instead of the planned linear battle.

With the Duke of York safely relieved of command (again), the British reverted to the melee battle. Off Texel, they found that the day of the melee was past. The skillful De Ruyter took the offensive and broke the British into three parts. Again, the French fled. The British, seeing themselves being worsted, withdrew. This battle was the last time the

British would try to melee battle. They were now firmly committed to the line ahead. As a result of this battle, Britain withdrew from Louis' unholy alliance.

The tactics De Ruyter had developed were a synthesis of the line ahead battle as the British had fought off Texel in 1653, and the traditional Dutch melee. While using the line in pre-combat maneuvering, he would mass a majority of his fleet against part of the enemy's hoping to destroy in detail, often by surrounding part of the enemy battle line. This was the technique of "massing." As events were to show, the people who learned De Ruyter's new tactic best were his enemy, the French.

The French, who had proven themselves cowardly while fighting with the British, were quite aggressive when they had their own self-interest to mind. They showed this by defeating De Ruyter off Stromboli in the Mediterranean in 1676. The great Dutchman was killed in action soon afterwards. This marked the eclipse of Dutch power. The trade once monopolized by the Dutch was now carried by the British and the rising new French merchant marine. The Dutch faded from the ranks of the premier maritime nations, leaving the British and the French the dispute the question of supremacy. This resulted in a period known as the Second Hundred Years War. This period, lasting from 1688 to 1815, pitted the Royal Navy, British strategy, and the armies of Britain's continental allies, usually judiciously reinforced by a British Expeditionary Force, against the gradually decaying *ancien regime* of France, with an army, navy, and strategy which varied from sublime to ridiculous.

THE WAR OF THE ENGLISH SUCCESSION (1688-1697)

The Duke of York was an indifferent Admiral. As James II, he proved a worse King, and was soon thrown out of his palace to find refuge with his old friend and co-religionist, Louis. So began the War of the English Succession, the first round in the Second Hundred Years War, that, after many ups and downs, would eventually see the Royal Navy triumphant.

While the ships, ordnance, and men were much like those who fought in the Dutch Wars, naval tactics had changed in that the melee style battle, that last vestige of the Middle Ages, had fallen from use. The huge fleets now fought in long line-astern formation, divided into three squadrons, a van, center, and rear. The battles of this period were usually linear battles.

The first battle of this war was off the pleasant Sussex coast at Beachy Head. There, in an attempt to mass against the French rear, the Anglo-Dutch split their fleet into three non-supporting squadrons. The French van squadron, however, took the offensive and surrounded the Dutch squadron, causing heavy loss with effective use of fireships. The close range action in the French rear also went in the French favor. The Anglo-Dutch withdrew. Many British officers interpreted Beachy Head as showing that a line which stayed together in one monolithic formation, could not be defeated by smaller, more flexible groups.

Two years after Beachy Head, the Anglo-Dutch got their revenge at Barfleur. Barfleur was almost a repeat of Beachy Head, except that the roles were reversed. The French, with

the British surrounding their van, fled into coastal waters. There, over a five day period, the British systematically put much of the French fleet to the torch, while the Dutch blockaded the rest. Watching the conflagration was the once Duke of York, now ex-King James of England and an exile in France. Although the fleet that went up in smoke was his last hope of regaining his throne, he still cheered on the navy he had once led.

Barfleur was the last Seventeenth century battle. The turn of the century brought with it a change in naval fighting. The huge fleets, fireships, and tactics of "melee" and "Massing" very soon became obsolete. The most important innovation in this turn of the century period was allowing the guns of a ship to recoil inboard when fired (before this guns had been fixed in position). This led to ships being built slightly wider to accommodate the backwards roll. This innovation increased firepower by upwards of 500% and led to a reduction in the number of ships in a fleet, a reduction which went on throughout the Eighteenth century, as fewer ships could do more damage.

THE SHIPS

Naval architecture was one of the beneficiaries of the scientific revolution of the Seventeenth Century. Hull design became more streamlined as shipwrights learned how to reduce underwater drag. Ships also became less topheavy, with the high upper deck of the galleons and much of the complex ornamentation of earlier ships done away with in the interests of greater speed and seaworthiness. The high deck, which had made galleons difficult to board, had become obsolete with the decline of boarding.

This revolution in shipbuilding, from the traditional to "scientific" methods, held true in some countries more than others. The French adopted it wholeheartedly. The Spanish belatedly joined in, and with the aid of foreign naval architects, produced some excellent ships. The Dutch, however, had to build light ships to fit into their shallow harbors. This limited their armament. The Russians, for the same reason, imitated Dutch ships. Surprisingly, Britain, birthplace of the new science, clung to antiquated naval architecture, and only kept abreast of foreign progress by copying captured ships. Indeed, throughout the age of sail the best ships in the Royal Navy were often captured French vessels.

Since the Royal Navy had metamorphosed the better part of the French fleet into charred driftwood in 1692, the French contented themselves with conducting raids against British and Dutch commerce, for the rest of the War of the English succession. Such raids, conducted either by small groups of warships, or armed, privately owned ships, known as privateers, were a nuisance. They forced the British and Dutch to take such precautions as escorting convoys, but it did not seriously affect trade. French trade, blockaded by the British and Dutch, stopped cold.

THE WAR OF THE SPANISH SUCCESSION 1702-1713

After a five year "time-out," allowing the French to rebuild part of their Navy, round two of the Second Hundred Years War began in 1702. Pitting Britain, the Netherlands, Austria, and Portugal against the usual alliance of France and Spain, this war was best known on land for Marlborough's campaigns.

This war also revealed a pattern that was to endure long after the age of sail. The British had let their navy decay in time of peace, in the name of economy. Because of this, they usually lost the first battle or two of any new war until they awoke from peacetime doldrums. This time, the rude awakening came off Cartagena in the Caribbean in September 1701. While strategically a British victory, it exposed much tactical ineptitude, and worse, several Captains who ran from action without orders. Incompetence was one thing, cowardice quite another. The offending captains were hanged, setting an example no British officer dare disregard.

Several indecisive actions followed. A Spanish treasure fleet was burnt in Vigo Bay. Meanwhile, the Royal Navy strangled enemy commerce, seized colonies throughout the world, including Gibraltar, and generally waited for the enemy fleets to emerge from harbor.

And emerge they did. The capture of strategic Gibraltar finally stung the French and Spanish to action. That action came off Malaga on 13 August 1704. While no ships were lost of either side in a day's fighting, the battle was in many ways one of the most significant actions of the Age of Sail.

Commanding the Anglo-Dutch at Malaga was Admiral George Rooke. Rooke had been influenced by the disorganized debacles of the Seventeenth Century to draw up a set of fighting instructions, determining what was to

be done in certain eventualities. This was nothing new. There had been sets of fighting instructions since the Sixteenth Century, used by the Spanish and Dutch as well as the British. Rooke's instructions, however, were extremely detailed, spelling out what he thought a naval battle should be like. Malaga was almost exactly what Rooke thought a naval battle should be like. It all went as per instruction. After pulling up opposite the Franco-Spanish fleet, out of range, the Anglo-Dutch reached down on them in line abreast, transferring back to line astern once in range. After a taste of superior Anglo-Dutch gunnery, the French withdrew. Gibraltar was saved. Rooke was convinced he was a genius. He promptly turned his fighting instructions into the "Fighting Instructions," which spelt out *exactly* how a battle should be fought. The model battle was, of course, Rooke's own victory at Malaga. As happens so often in every field, suggestions become doctrine which, in turn, become dogma. If nothing else, the "Fighting Instructions" were dogmatic. From 1707 on, fighting a battle which deviated from the norm of two evenly matched parallel lines (with the British being up-wind) was punishable by court-martial.

Here we see a trend that was to continue to 1778. Naval battles had become formalized, linear affairs, as rigid as the lines which dominated the land warfare of the period or the quadrille danced in contemporary ballrooms. From here until 1778, there is an almost total lack of decisive battles. The only way one

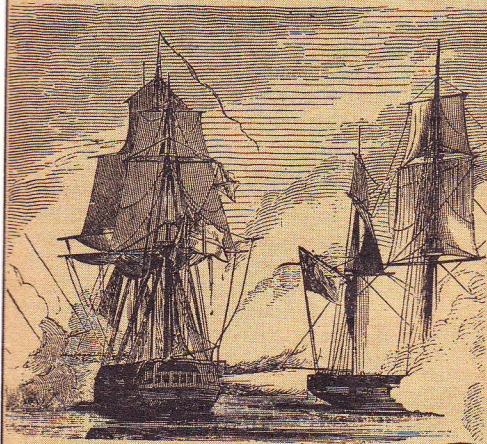
could effectively defeat the enemy and not get court-martialed for it was by the "General Chase," with all the British ships sailing after all the enemy ships in a free-for-all chase. But this depended on the audacity of the commander. The decisive element had gone out of naval tactics.

It had not gone out of naval strategy, however. After Malaga, the Franco-Spanish stuck to port, with the British drinking their grog, and blockading their harbors. French commerce-raiding, while a nuisance, could not disrupt British commerce to the effect that it would win wars. The French had a name for this tactic: *guerre de course*. It meant sniping at the enemy where he is weak, causing trouble where possible, but not engaging in decisive combat. Unfortunately for the French, it never worked. The British navy had complete control of the sea. When the war ended favorably for Britain and her allies in 1714, the Royal Navy had sunk or captured 50 enemy ships of the line and 85 smaller ships, while losing sixteen ships of the line and nineteen smaller vessels to enemy action.

THE GREAT NORTHERN WAR 1701-1721

The Russians and the Swedes renewed their long-standing animosity with Peter the Great's search for warm-water ports. As in most of the Russo-Swedish conflicts, most of the fighting was done by oar-powered warships. Yet both sides did have squadrons of sail warships. The decisive action was off the Swedish fortress of

(continued on page 32)



Frigate!

The frigate is, by definition, a light, fast, warship. There had always been ships smaller and faster than others. Such ships, like the frigates which followed them were used for scouting, carrying dispatches, protecting and destroying trade, watching over a country's interests in remote parts of the world, and all manner of other duties for which Admirals were unwilling to disperse their vital ships of the line to perform. Frigates were supposed to run away from anything that could defeat them and defeat anything that could catch them. They ranged in armament between 28 and 54 guns. While there had been small, fast

warships called frigates since the mid-seventeenth century, it was not until the 1750's that the real frigate appeared on the scene.

The true frigate, although a French invention, was soon adopted by all navies. The British built many frigates to protect their widespread trade. This demanded quantity rather than size, so most British frigates built before 1793 were armed with 36 guns or less. The French, however, had always envisioned the role of their frigates as corsairs, ambushing enemy merchantment upon the high seas and able to dispatch a smaller British frigate if one should interfere. The British soon captured a number of these fine French frigates, and began to build copies, especially after 1793, when a 44 gun example was taken.

Yet due to their world-wide commitments, the Royal Navy never had enough frigates to go around, and their absence often made scouting difficult. In 1798 Nelson himself said "were I to die this moment, want of frigates would be found engraved upon my heart." Yet British frigates did all right. From 1793 to 1815, the British took 229 French frigates plus 106 Spanish, Dutch, and other nationalities, while losing but eight of their own.

The Spanish built frigates similar to the French after the 1780's. French frigate design became universal, although often less heavily armed. The epitome of frigate construction came, however, from America.

As the Americans did not possess a fleet of ships of the line, they decided to pin their hopes in time of war upon coast defense and commerce destruction. This last end was to be accomplished by a class of Frigates which were often bigger, stronger, and more powerful than any others. Although rated as "44s," these ships actually carried 54 heavy guns. Using six of these frigates and several smaller ships and well-trained gunners, the American frigates defeated several French and British frigates, in single-ship actions. While these actions were embarrassing to the British and French, neither navy was harmed by the loss of a few frigates.

While frigates were important, they were not decisive weapons. In large fleet actions, they generally kept out of the way and were limited to repeating signals. They could not stand up to a ship of the line in a gunnery duel, although several times British frigates took small ships of the line in single-ship actions. In fleet actions, however, the etiquette of the period held that no ship of the line would fire on a frigate unless the frigate fired first.

Sloops, which carried some twelve to eighteen guns, were generally used for the same duties as frigates, although with a greater emphasis on trade protection. The French called their sloops corvettes. They were often actually small frigates. Sloops were also greatly favored by privateers and pirates. Brigs were often, but not always, smaller than sloops, the main difference being in the mast structure.

Naval Ordnance

While firearms had been used at sea as early as the Hundred Years War, it was not until the mid-sixteenth century that cannon became the decisive weapon afloat. This came about because improved metallurgy enabled cannons to be cast in one piece, rather than being built up in layers as before. Cannon could now be made larger and, as they were stronger, fire a larger shell farther than previously thought possible. These new weapons enabled the British to defeat the Spanish Armada in 1588. Before the invention of the cast guns, guns were of necessity smaller weapons that could only kill men, not damage ships. These were the type of weapons the Spanish found so ineffective in 1588. Even though obsolete, such small anti-personnel weapons lingered on for many years.

By 1650, the cast, smoothbore gun was used throughout Europe's fleets. Yet the cannon were often non-standardized, and based on the model of land artillery. The Dutch were the first to use as standardized system of artillery. Just as important, the Dutch gunners were sailors, who could help sail the ship, and not landmen artillerists, as in the Spanish and other navies. This contributed to the several Dutch successes over the British in the Dutch Wars. The rest of Europe soon adapted themselves to the Dutch system, and by 1665, naval ordnance had basically reached a plateau on which it would remain until 1837.

Unlike modern naval warfare where there is often significant difference between the ordnance of different navies, the age of sail had the muzzle-loading cannon, as a universal weapon. There were, however, national differences. French, Spanish and Danish guns usually fired a shot some 15% heavier than that listed here, with a subsequent reduction in rate of fire. Spanish gun carriages were also heavier than those listed. American guns were somewhat lighter and longer ranged, although the guns themselves were just as heavy.

The average Naval gun of 1650-1830 was of brass, and in one of the following standard sizes: 32 pounder, 24 pounder, 18 pounder, 12 pounder, and 9 pounder, with smaller guns also being used. The weight designation refers to that of the solid iron cannon ball (or solid shot) that the gun fired. It was not until 1837 that shell ammunition that exploded upon hitting its target was invented.

As well as weight, guns were differentiated by the length of the barrel. Most cannon were from nine to ten feet long. The length was kept down because the longer a gun was, the farther back it would recoil when fired. There were, however, long guns, usually some twelve feet in length. While usually 18 pounders or less, these guns had

the range of the 32 and 24 pounders or more. These long guns were generally used in the bows and sterns of ships, for use when chasing or running at long range, or by fast ships who would rather engage more heavily armed opponents at a distance, as a privateer might.

A typical 32 pound gun of 1650-1830 period would, on paper, have a crew of twelve men. However, in the British Navy, it was usually not possible to keep the gun crews at full-strength, and guns were worked with as few as five men. The Spanish Navy, on the other hand, would often over-man each gun with landmen artillerists, as well as sailors, with the result that they would get in each other's way.

One reason that the rates of fire of these guns were so heavily dependent on the training of their crews was because of the teamwork called for by the complicated task of using the guns. Here is a *simplified* list of the drill that had to be followed every time the gun was fired:

1. The gun having recoiled itself backwards, the crew stand in two rows on either side of the gun. The man on the left nearest the muzzle puts a cartridge of black powder down the muzzle and the man opposite rams it home.
2. The gun-captain behind the gun primes the cartridge and the flintlock.
3. The first man on the left puts a wad and a cannonball down the muzzle, and the man opposite rams it home. The gun crew heaves on the tackle, and the carriage rumbles forward until the muzzle sticks out of the gunport.
4. The gun-captain takes aim, and the two men nearest him alter the elevation and traverse with crowbars and blocks of wood. If any large corrections are needed, the gun is manhandled around by the entire crew.
5. The gun-captain cocks the flintlock, and stepping out of the way of the recoiling gun, pulls the lanyard.

Steps 3 and 4 were easier on the Royal Navy after 1782, when spring recoil buffers and gun-training equipment were introduced. The guns were fired, before 1770, by using a linstock instead of a flintlock. A linstock was a burning piece of rope touched to the powder charge to set it off. The use of the flintlock, was one might imagine, was a great boost to both safety and efficiency.

Although the British were often undermanned — at Trafalgar only one ship was up to strength — they compensated for this by their excellent training which, at the time of Trafalgar, enabled a British 32 pounder to fire three rounds in two minutes, twice as many as the French or Spanish. The Dutch, in their better moments, could approach the British standards. And in the 17th century it was the Dutch who were the models for gunnery. They taught the British

many hard lessons on the subject. The Americans were much like the British in their high rate of fire but, especially in 1812-14, they relied greatly on individual gun aiming and accuracy. The Americans even installed makeshift sights on many of their guns. This resulted in unequalled accuracy which, coupled with their high rate of fire, made the Americans quite a formidable bunch. Any aiming of a smoothbore weapon, especially one as roughly made and handled as a naval cannon, was necessarily inexact. The British, like the Americans, relied on the gunner at each gun to aim them. The Spaniards would have "master artillerists" who would often go from gun to gun to aim them.

While a 32 pounder, the standard gun of ships of the line, might have a maximum range of 2,100 yards, battles were usually fought at closer range. One of the reasons for this was that a ship's first broadside was its most accurate, as there was more time to aim the guns and the gunners view was not obscured by the smoke of previous discharges. Many commanders were loath to "throw away" their first broadside advantage at long range, where few of even the best aimed rounds would hit. The French, however, made a practice of always firing at the longest possible range. While this would sometimes result in important damage before the close range action began, more often than not, it was a waste of ammunition. The French also made a habit of firing their guns high as the ship rolled upwards on a swell. This would direct the weight of French fire against the masts, sails, and rigging of their enemy. Hits there would often dismast a ship and slow it down, but it would not put the enemy's guns out of action. This reflects the French dislike for pitched battles. The British, on the other hand, were never adverse to fighting close-in, and so they would fire low on the ship's down-roll, often skimming the cannon balls off the surface of the water for extra range. These shots would hit the enemy vessel low, knocking out guns and killing crewmen. No navy limited itself to any one type of firing, however, and a good Captain would know where to fire depending on the tactical situation.

When fighting got close, cannon would often be double-shotted, with two cannon balls put in at the same time. This was not a recommended procedure as it placed undue strain on the gun, made the flight of the shot even more erratic than usual, and used up ammunition rapidly. But used in the proper circumstances, it could be deadly. At Trafalgar, H.M.S. *Victory* delivered its first broadside, some 52 guns (including two carronades) all double-shotted, into the glass stern of the French *Bucentaure* at a range of five yards. The

French ship never recovered from that broadside and soon struck.

One of the innovations of the period was the carronade. Introduced in 1778, the carronade was primarily a British weapon, although employed by other navies as well. It fired a large projectile for a short distance with enormous force. Due to its already limited range, it was often double loaded. Their use gave the British an advantage in close range gun fighting, and carronades were in part responsible for the British victories at the Saintes and Trafalgar, where they were used with devastating effect. The short range of the carronades was, however, a severe limitation. One American frigate, armed solely with carronades, was defeated by a smaller British vessel armed with long guns which stood off out of range of the American.

Cannon could fire other types of ammunition used besides solid shot. Grape was hundreds of musket balls in a serge bag. It would burst open when fired, with the cannon acting as a huge shotgun. While these small projectiles would not harm a ship, they would be lethal to men working exposed guns or up in the rigging. Chain shot (two cannonballs chained together) and bar shot (a dumbbell) was used against rigging, where their elongated shapes would rip sails and cut lines, but they were so inaccurate that only the sharpshooting Americans could use them with any effect.

In the 1790's the French attempted to use red-hot shot aboard ships. Red-hot shot were cannonballs that had been heated in a furnace before firing. If such a projectile hit a wooden ship, the results can best be imagined. A Spanish fleet attacking Gibraltar in 1782 was defeated by British coast defense using this weapon. The French attempts at innovation, however, proved disastrous. Not only was there the danger that the red-hot shot would set off the powder in the barrel of a cannon before it was fired, but British shot would often hit the furnaces, scattering burning coals throughout the French ship. After several French ships had burnt in this manner, the French quickly gave up the idea of red-hot shot at sea.

There were also a variety of exotic ordnance. The bomb ketch carried two large mortars which fired exploding shells, or "bombs." Although useless in a naval battle, they were effective against stationary ships and forts, and in that role are commemorated in the American National Anthem.

One of the most spectacular weapons was the fireship. As its name implies, the fireship was a ship filled with inflammable material and manned by a skeleton crew. At an opportune moment, the crew would set the ship alight, abandon it, and let the wind carry it into the enemy where it would hopefully collide with and set ablaze the

enemy vessels. Such weapons were successful against the Armada in 1588, and were used with great effect in the three Dutch Wars. As ships became more maneuverable, they were able to avoid fireships at sea, and so fireships were only

used against anchored ships, in which role they could remain effective. But by the Napoleonic Wars the fireship was almost obsolete, and few, if any, of the attacks made using this weapon succeeded after 1793.

NAVAL ORDNANCE

1588-1680

Type	length	wgt.	RoF	eff.	Range max.	crew
1 ½ pdr. falconet	4"	210	3	50	1900	3
18 pdr. culverin	11"	4000	2	330	2500	4
24 pdr. Perier	11"	4500	1 ½	265	1500	3
32 pdr. cannon	13"	5000	1	280	2000	3

1650-1837

Type	length	wgt.	RoF	eff.	Range max.	calibre	crew
60 pdr.*§	—	8500	- / 1 ½	330	2300	—	—
42 pdr.*	10'	6500	3/2	320	2100	7.03	—
36 pdr.†	9'	6100	- / 3	280	1800	6.43	18
32 pdr.	9'6"	5500	6/3	300	2100	6.43	12
24 pdr.	9'	5000	6/3	290	2000	5.84	10
18 pdr. long	9'6"	4200	6/3	330	2600	4.20	8
18 pdr.	8'6"	3900	8/4	270	1900	5.30	8
12 pdr.	8'	3200	8/4	250	1800	4.65	8
68 pdr. carronade‡	5'2"	3500	8/-	150	700	—	6
32 pdr. carronade‡	4'0"	1700	10/-	75	350	—	4

EXPLANATION OF CHART:

* Gun was generally out of service before 1800.

§ Used by French and Spanish

† Never used by R.N. or U.S.N.

‡ Used only by R.N. and U.S.N.

The guns are divided into two parts, showing the evolution in the mid-seventeenth century. *Type*: The name of the gun and the weight of shot if fired. *Length*: From muzzle to rear, in feet and inches. *Wgt*: weight of gun and carriage in pounds. *RoF*: Rate of fire. Expressed in number of shots per ten minutes, 1588-

1680; per four minutes, 1650-1831. The 1588-1680 figures are for a good guncrew. The split figures in the 1650-1837 category represent British and American crews with the first number, and all others with the second number. *Range eff.*: The weapon's effective range, within which it did most of its damage. *Max*: The weapon's maximum range, the furthest it could fire a solid shot, although with little accuracy. *Calibre*: The diameter of the gun's muzzle in inches. *Crew*: Standard number required. Sometimes more were used, more often, less men were available. A dash represents unobtainable data. In other cases, the data has been estimated where unavailable.

(continued from page 29)

Visby in 1704. There, the Russians, commanded by an Englishman whose name is unfortunately unrecorded, defeated the Swedes. This resulted in a Russian victory, giving them what was to become St. Petersburg (and is now called Leningrad).

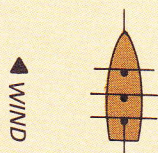
Swedish attempts to recover from this setback were stopped by the Russian naval victory at Gangoot in 1714.

The Russians and the Swedes clashed periodically until 1807, but these wars produced no great naval actions. Neither did the several Russian wars against the Turks in the same period.

WAR OF THE QUADRUPE ALLIANCE 1718-1720

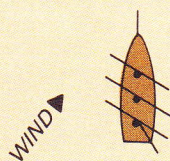
A brief war that saw the British intervening in European affairs to maintain the balance of power, seeing that no nation became so strong as to be overpowering. Were this to be the case, that nation would doubtlessly threaten

Shiphandling



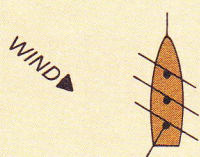
RUNNING

Running (going directly with the wind) results in a fair turn of speed, but the mizzenmast tends to mask most of the other sails.



REACHING

This is the fastest type of sailing, with each sail having fullest exposure to the wind. The angle each ship would sail at to attain its maximum speed was its "point of sailing" and differed from ship to ship.



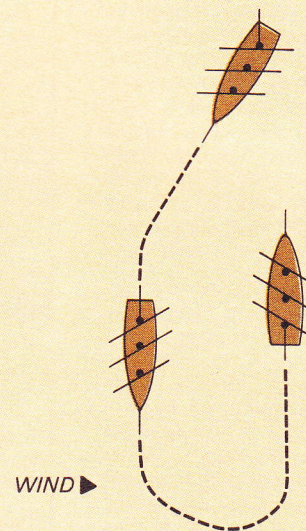
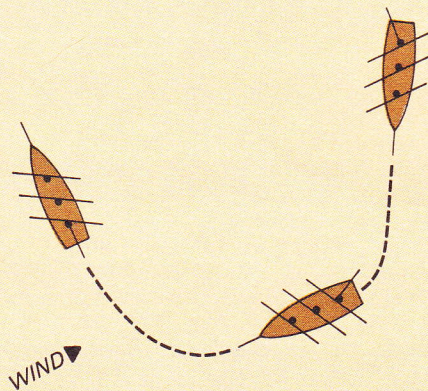
BEATING

This is the slowest type of sailing. Square-rigged ships could not get more than 20-25 degrees into the wind and still make headway.

A sailing ship's speed is dependent upon many things: its hull-design, its type of rigging and masts, its weight, state of disrepair, the height of the sails, the efficiency of the crew, and many more factors. Therefore, one can do little more than generalize. Ships of the line and most merchantmen had a maximum speed of between four and eight knots. Frigates and smaller vessels would vary from seven to twelve knots top speed. This varied according to type. British 100's and French 80's were renowned as fast sailers, while British 98's and 80's were notoriously slow.

TACKING

Tacking was the normal procedure for changing course "through" the wind. It could only be done by ships with a large crew, usually warships, as it required many men to work the sails during this complex maneuver. If it was improperly done, or attempted in too high a wind, the ship could be taken aback, and stopped dead in the water at the mid-point in the diagram. This eventuality was usually accompanied by the ripping of the canvas, the parting of the ropes, and the cursings of the officers and men. It was also difficult to tack a shallow draft ship, which put Dutch and Russian vessels at a disadvantage. On the average, a 100 gun ship required 250 men working the sails and rigging to tack. A 44 gun frigate, would need only 150 men, although a poorly disciplined crew would require more men and time and better crews, including most of the Royal Naval, could do it quicker and with less men.

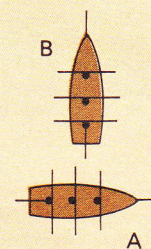


WEARING

Wearing was another way of changing course. It took more room and time than tacking, but it had the advantage of being easier on both the ship and crew, thus a ship could wear even when undermanned, with a poorly-trained crew, or with a high wind.

Raking

One of the most effective tactics was raking. This was the age-old practice of "capping the T," sailing the attacking ship across the enemy's bow or stern. Not only would this enable the attacker to fire all his guns, as compared to only the two to six guns in the bow or stern the defender could muster, but the cannonballs of the raker would bounce down the decks of the target ship, doing great damage. When one remembers that the sterns of most warships were made largely out of glass, the effectiveness of this maneuver becomes apparent. One of the disadvantages of attacking during the age of sail, was that to point a ship's bow towards the enemy exposed it to raking fire, although the attackers would be able to do the same thing if they broke through the enemy line of battle. In small, frigate actions both ships would maneuver to attempt to rake the enemy ship.



Ship A is raking Ship B.

Britain. This remained a tenet of British strategy into the Twentieth Century.

The war is marked by British expeditions against Spanish colonies, Spanish trade, and the decisive battle of Cape Passaro. This was the first of many battles the British won using the "General Chase." In this case, the Spanish ran as soon as they saw the British coming. The British did not bother to form up in battle order, but went after them. Although Spanish ships were usually faster, superior seamanship allowed the British to close in. Once in range, superior British gunnery decided the action. This battle had the effect of crippling the Spanish fleet for almost twenty years. With much of their fleet gone, the Spanish sued for peace. In the war, eight Spanish ships of the line were taken and seven burnt or sunk; fourteen smaller ships were taken and one was burnt. The British lost no ships in the action.

THE WAR OF AUSTRIAN SUCCESSION 1739-1748

The War of Austrian Succession was a complex series of conflicts, starting with the Anglo-Spanish war in 1739, a conflict into which the larger issues of Europe inevitably were meshed. The first five years of the war were devoid of strategic actions, the British being content with watching the Spanish fleet, occupying Spanish colonies, and disrupting Spanish trade. This breathing period gave the Royal Navy time to "warm up" and avoid the usual defeats engendered by peacetime decay. The French and Spanish Navies, however, were very much in a run-down condition, with poor ships commanded by ill-trained officers who had little idea of how to use them. As the crews had not been to sea, they could not practice their skills.

The war escalated, as might be expected, and in 1744 France joined the forces opposing Britain. It was not long before the British encountered their new enemies. While Sir Thomas Mathews' Mediterranean fleet was pursuing a French convoy, the British found themselves confronted, off Toulon, with the main Franco-Spanish fleet. Mathews decided to concentrate his ships against the enemy's center and rear, hoping to overwhelm them before the van could wear around and come to their assistance. While the plan was tactically sound, it was in violation of the "Fighting Instructions." Although Mathews' subordinate refused to violate the Instructions and attack, Mathews went ahead. The plan worked, but poor communications and several faint-hearted captains allowed the enemy to escape after losing but one ship. Still, it was a victory. On his return to Britain, however, Mathews was court-martialed for violating the "Fighting Instructions." He was convicted, cashiered, and imprisoned. His inept subordinate was acquitted. The dead hand of the "Fighting Instructions" now became holy writ. It was better to lose a battle while adhering to the "Fighting Instructions" than to deviate from it and win. [Toulon was also notable for being one of the last sea battles in which fireships were used, although without success.]

This trial resulted, as one might expect, in unthinking obedience to the "Fighting Instructions." The officer commanding the British squadron off Madras, in India, allowed his obedience to prevent him from effectively countering the French squadron in the area. As a result, the French gained the strategic advantage of control of the sea. This enabled them to blockade Madras, transport troops to capture it, and sever British trade.

While the British seized more French and Spanish colonies, other, more aggressive British Admirals found a way to defeat the enemy and not get court-martialed. Admiral George Anson encountered a weak force of French ships escorting a convoy off Cape Finisterre in 1747. Anson began the battle in accepted "Fighting Instructions" form, but when the French fled before close action could be joined, Anson ordered a "General Chase," much as had occurred at Cape Passaro in the previous war. As at Cape Passaro, superior British seamanship enabled them to run down and capture the nominally faster enemy. All of the French ships opposing Anson were overtaken and captured, as was much of the French convoy.

Several months later, the same British squadron, now commanded by Admiral Edward Hawke, encountered a slightly larger French squadron, also escorting a convoy, in the same place Anson had defeated them. This Second Battle of Cape Finisterre was almost an exact repeat of the first one, although this time two French ships escaped. Hawke, by refining the techniques of the General Chase had exemplified the qualities that made it a decisive weapon. These were mobility, flexibility, use of superior British seamanship and gunnery, and allowing the British to mass against part of the enemy. Advantages which the standard "Fighting Instructions" lacked. Unfortunately, the General Chase only worked if the enemy was kind enough to run away before their fire had damaged the British enough to slow them down. If the enemy stayed and fought, the only solution, under pain of court-martial, was the stale repeat of Malaga forced by the "Fighting Instructions."

The "General Chase" could also be used as a pursuit after a "Fighting Instructions" formalistic battle. It was used in this manner off Havana in 1748, with modest, but definite, success.

When the war ended in 1748, the naval balance stood very much in Britain's favor. They had taken or destroyed 21 French and fifteen Spanish ships of the line, along with eleven French and sixteen Spanish smaller vessels. The French and Spanish merchant marines were decimated by the loss of 3,434 ships. In return, the British had lost only two ships of the line and ten smaller vessels to enemy action. More serious was the loss of 3,238 merchant ships, but their loss was made good with captured enemy vessels. Yet despite these impressive victories, the British discovered that seapower had its limitations. They found out that British colonies were just as vulnerable as any other if not defended properly. Nor did seapower protect British allies in Europe from being overrun by the French Army. To support her continental allies, the British had to use a large British Expeditionary Force and sizable loans. Yet the effects of war at sea had prevented the French from conquering much of Europe, and the demise of French trade had nearly bankrupted the French economy. The French Navy was still in eclipse. They could see no other purpose for venturing outside of harbor than protecting their own convoys or colonies, or trying to seize enemy ones. The Spanish Navy merely reflected that nation's decline.

THE SEVEN YEARS' WAR 1756-1763

The long-standing Anglo-French commercial and colonial rivalry triggered the next round in the Second Hundred Years War. Both the British and the French had designs for colonial

expansion in India, America, and the Mediterranean.

It was over the British colony of Minorca, in the Mediterranean, that the first battle was fought. Like most first battles, it was a debacle for the British, still slumbering under peacetime complacency. The British had sent Admiral Byng, with a motley and over-age squadron to defend Minorca. When he encountered a French squadron attempting to blockade Minorca, Byng attacked it, adhering to the letter of the "Fighting Instructions." Due to his own ineptitude and that of his subordinates, even that became muddled. The French withdrew after damaging a British ship. Byng, discouraged, retreated to Gibraltar, abandoning Minorca to the French. This resulted in a public outcry against Byng, who also conveniently served as a scapegoat for all concerned with British unpreparedness. He was tried for his slavish following of the "Fighting Instructions" and subsequent blunders, convicted, and finally shot "to encourage the others."

After putting their own house in order, the British went to their traditional strategy with a vengeance. Loans and a small army supported Frederick the Great against Britain's foes on land. Overseas, after initial reverses in 1756, the large French colonies in India and Canada fell into British hands, permanently, as did a number of smaller ones. Where was the French fleet while all this was going on? Safe in port. The quality of the officers and crews was very low, administration was poor, and strategy non-existent. The energetic new French minister of Marine, Chosieul, however, started to revive the French Navy from its half-century long slumber. Yet he could not prevent the French colonies from withering on the vine, along with French trade, because of the British control of the seas. Nor could he prevent the British supplying their continental allies.

With the colonies already gone past redemption, in 1759 Chosieul came up with a rare thing in the French Navy — a strategy. The two French fleets, at Brest and Toulon, would slip out to sea, and then rendezvous to chase the British from the Channel, preparatory to an invasion. Needless to say, the plan was not successful. The Brest fleet, soon after it sortied, was intercepted by the British. In a "General Chase" action in the teeth of a gale the British sank or drove on shore most of the French Brest fleet. Both sides lost more ships from weather than from enemy action. The "General Chase" battle had now become so widespread that additional "Chasing Instructions" had been issued. These came into play again at Lagos, off Portugal, when the escaping French Toulon fleet was finally caught. It was also trapped between the British and the shore and was effectively defeated. The British had quashed the French invasion, not by coast defense, but by stopping it from ever getting started. It was fortunate for the British that the French disliked close action, and would run rather than fight it out, line to line, with the British. If the French had stayed to fight, the British would have had to use the "Fighting Instructions" type battle, which seldom gave any success. The "Fighting Instructions" still remained in force. A series of battles were fought off India using the "Fighting Instructions" to the letter without taking advantage of the General Chase. While the British sank or drove ashore most of the these actions, they still were able to keep

control of the Indian Ocean by superior strategy.

It was this superior strategy that had made the Seven Years' War into such a resounding success for Great Britain. The French had been defeated at sea. When the Spanish were rash enough to join the struggle in 1762, they too were soundly beaten, losing their colonies of Cuba and the Philippines to the British. Their fleet was decimated off Havana, which was more of a mass surrender than a battle. Canada and India fell to the British permanently. Others, such as the Spanish conquests, had to be returned. The British had succeeded in aiding their Continental allies (although not enough, according to the allies), preserving the balance of power, and maintaining British trade. Surprisingly, the British lost more merchant ships than the French, 800 to 300. These losses, caused by French commerce raiding, were but a fraction of the over 8,000 British ships then plying the oceans. The French merchant marine rotted in port, blockaded by the British. The French lost 35 ships of the line and 50 smaller ships. Their erstwhile Spanish allies lost twelve ships of the line and six smaller ships. The Royal Navy lost two ships of the line and seven smaller vessels.

DEVELOPMENTS, 1763-1775

The decade and a half following the end of the Seven Years' War saw changes in many forms of naval science.

In France, the energetic Chosieul, undeterred by the defeats of the Seven Years' War, directed the rebuilding of the French Navy. New ships were constructed. Reforms in gunnery, officer training, and tactics were proposed, although most remained on paper. Yet enough was done to get the French Navy out from the doldrums where it had lain for most of the century. These reforms, naturally, cost money, and they greatly contributed to the growing bankruptcy of the French monarchy.

Spain also underwent naval reform, although of a more limited type. The Spaniards realized that their naval architecture, while in the forefront of the world in the late Sixteenth Century, had slipped. They hired foreign naval architects and technicians who helped the Spanish build a new fleet of impressive ships.

The Russians, Swedes, Danes, and the once mighty Dutch all possessed navies that were little more than coast defense forces.

In Britain, copper sheathing was introduced on ship's hulls. This helped prevent corrosion and the growth of marine organisms that would cling to the ship and reduce its speed. This innovation raised the relative speed of British ships until other nations adopted it later in the century.

Another innovation of the British turned out to have less fortunate results. They had begun to run short of the excellent British oak which was the best type of wood for shipbuilding. Unfortunately, they tried to substitute a cheap and nasty variety of German oak that rotted away after twenty-five years or so. This was quite a setback in the days when a warship was good for at least forty to sixty years of service. Mahogany, teak, and fir were sometimes used instead of oak. Although it offered less resistance to cannon balls, fir retained a certain elasticity which sometimes caused enemy shot to bounce off. This gave the fir-built frigate *U.S.S. Constitution* her nickname of "Old Ironsides."

(continued on page 36)

Fleet Tactics in Practice, 1666-1805

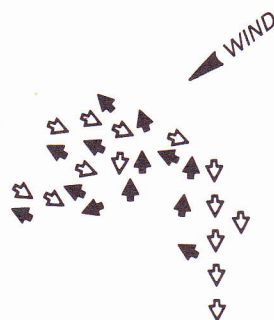
Diagrams are not to scale and show relative position only.

In the first three diagrams, each symbol represents a group of ships. In the second three diagrams, each symbol represents one ship.

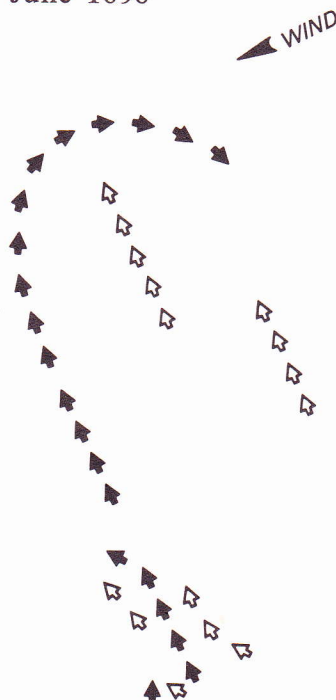
▲ = British ship(s)

◆ = Enemy ship(s)

A Melee Battle in Progress The Four Days Battle, Afternoon of the First Day, 11 June 1666



The Line Ahead Beachy Head, 30 June 1690



The Formal Battle as Intended by the "Fighting Instructions" Malaga, 13 August 1704

The trials and tribulations of naval fighting in the 1690's led to the rise of the "Fighting Instructions" and the formal battle that was to exert such a powerful influence over naval tactics for most of the eighteenth century. The Anglo-Dutch commander at Malaga was Sir George Rooke, who had written the "Fighting Instructions" and as a result of their success at Malaga was to codify them. Malaga was as close to a standard battle as set down by the "Fighting Instructions" as ever occurred.

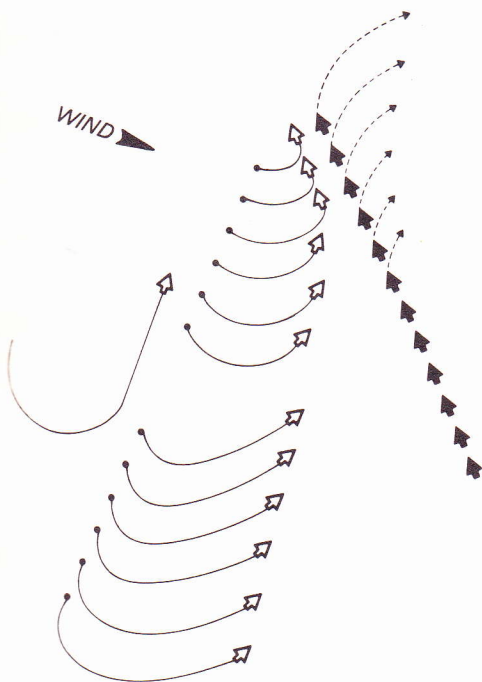
Rooke brought his fleet alongside the Franco-Spanish line, but out of range. As the enemy patiently waited, Rooke ordered his fleet to turn, simultaneously, towards the Franco-Spanish in line abreast. As the Anglo-Dutch approached, the Franco-Spanish fired high, damaging the sails and rigging of some ships. As soon as the ships came into close range, Rooke ordered another simultaneous turn, this time into line astern, with the two fleets now parallel at close range. The two fleets then battered away for hours. The superior Anglo-Dutch gunnery was telling, but they suffered from limited ammunition. The Anglo-Dutch had superior numbers, but did not engage with their extra ships. Rather, they stayed behind the line to relieve damaged or out-of-ammunition ships. After several hours the Franco-Spanish realized they were getting the worst of things and withdrew. Rooke did not pursue. Thus, because Rooke did not lose, the "Fighting Instructions" became holy writ. Had Rooke thrown his own instructions and caution to the winds, and had he used the tactics Nelson was to use a few score miles away and a hundred years later, he could have scored a decisive victory. But Rooke was no Nelson and could only manage a battle with no ships lost on either side. There were, however, problems in this kind of formal battle, as the British were soon to find out.

The Formal Battle in Actuality

Minorca, 21 May 1756

The formal battle did not always turn out as set down by the "Fighting Instructions." Minorca was one of the most typical failures of this period.

Things began to go wrong for the British at once, because the turn to line abreast was not simultaneous, due to communications difficulties. The plan to get opposite the enemy and then reverse course was too complicated, especially when attempted by an untalented Admiral like Sir John Byng and an even less talented second-in-command. The ships turned one at a time, losing the impact of a combined attack. The command problems caused a gap between the two British forces. The French fired at the British as they approached them, aiming for the masts, sails and rigging. The sixth ship in line was damaged and wandered off, further confusing the situation. As the first British ships finally engaged, the French showed their dislike for close action and turned away, each French ship following the example of the one before it. Byng might have ordered a chase, but he did not. One French ship had been damaged, as had one British. The British ship that did not engage was the thirteenth ship, and its use in battle would have given the British a numerical superiority, an eventuality not covered in the "Fighting Instructions." This was almost the stereotype of battles fought throughout the 18th century. While other British Admirals were not shot for losing (as Byng was) they did not capture many ships, or lose many of their own. The only chance for victory came if the enemy were pursued if they ran, using the "General Chase."



The General Chase Battle First Finisterre, 3 May 1747

The "Fighting Instructions" had proved to be a dead end. The only way a battle could be won without violating the Instructions (and getting Court-Martialed) was by a "General Chase," such as won the First and Second Battles of Cape Finisterre, Cape Passaro, Quiberon Bay, Lagos and the "Moonlight Battle."

The General Chase would occur, as it did at First Finisterre, when the French decided they would not stay to be engaged at close range by the British. In this case, the British under Anson were still approaching the French when they decided to retreat. Rather than forming a line of battle, Anson had more sail put on and ordered the signal for "General Chase." This meant every ship was to sail towards the enemy as rapidly as possible, disregarding any formation. Although the French ships were usually faster, the leading British ships sailed through the ranks of the fleeing French, only engaging the frontmost French vessels. This slowed the French down enough for the rest of Anson's fleet to come up. When the rest of the British came up, it resembled an old fashioned melee type battle, with much confusion and little semblance of formation. When the smoke cleared, every one of the French ships had been captured. Also as a result, many merchantmen of a nearby French convoy were captured. This was the only clearcut victory that was possible under the "Fighting Instructions." Fortunately for the British, there were enough men willing to use this tactic. It was the only way they could throw off the overly formal linear tactics, and in doing this, inspired men such as Lord George Rodney to finally drop the dogmatic "Fighting Instructions" over the side.

The Non-Linear Battle Trafalgar, 21 October 1805, 12:45 P.M.

In 1782, Admiral Rodney, at the Battle of the Saintes, pierced the French line for the first time since the 17th century, won, and was not court-martialed. This set into motion a set of actions which led to the non-linear battle.

At Trafalgar, Nelson adopted the non-linear battle, closing with the Franco-Spanish line in many places and destroying it in detail. Such a maneuver would have been impossible had it not been for the very high quality of Nelson's captains and crews, or the fact that the French and Spanish gunnery was usually poor and aimed high. This enabled the British to close without suffering much damage. Once at close range, superior British gunnery carried the day, with a British 64 gun ship raking a Spanish 130 and forcing her to strike. Nelson's captains knew exactly what to do, guided simply by Nelson's instructions that "no captain can do much wrong if he puts his ship alongside one of the enemy's." Nelson was that confident that his men and captains knew what to do, he hoisted only one signal, that for close action. Following it with the words "England expects every man to do his duty." That expectation was fulfilled. The Franco-Spanish fleet was destroyed. The Royal Navy was triumphant.



(continued from page 34)

But by far the most unfortunate development of this period for the British was that a spirit of complacency had developed. A mighty empire had been won, the enemy scattered, and there was no future challenge in the offing.

THE WAR OF AMERICAN INDEPENDENCE 1775-1783

The War of American Independence began as a British internal matter. It ended as a worldwide war that stretched the Royal Navy to the limit. The first two years of the war were notable for their dearth of naval action. The rebellious colonies, of course, had no fleet, although they outfitted numerous privateers to prey upon British commerce. The British situation was hindered by the fact that a sizable proportion of the British merchant marine was in fact American and the ships which once carried part of Britain's trade were now being armed as privateers. Despite this, the Royal Navy had effectively blockaded the rebellious colonies when, in 1777, the French seized the opportunity for their long awaited *revanche*, and declared war on Britain. The Spaniards, sharing the same motivation, soon joined in. Maladroit British diplomacy even led the Dutch, Britain's ally since 1688, into declaring war.

Strategically, the British were in trouble. They could find no continental ally to carry the burden of the land fighting. Almost all Europe was engaged in unfriendly "Armed" neutrality. It was up to the Royal Navy to rescue Britain from its precarious position.

In July, 1778, the French Brest squadron felt itself fit to go to sea. When the French encountered the blockading British force, however, they quickly displayed their dislike of pitched battles, and withdrew. The British pursued for four days before engaging in an indecisive action off Ushant. The culprit was again the "Fighting Instructions" and poor command control. As might be expected, the usual court-martials followed. The British Admiral, Keppel, was, however, acquitted. He went on to devise an effective signal flag that would improve British command control and prevent repeats of Ushant.

In America, now but a sideshow of the global conflict, the one advantage the British had enjoyed, since 1775, was command on the sea. Sea transport gave the British Army mobility. This advantage was threatened when the French West Indian fleet began operating off North America during the summer and fall hurricane season. An attempt to destroy this fleet, in the best British manner resulted in the muddled Battle of Grenada. It was a standard "Fighting Instructions" style duel of lines. Unfortunately for the British, the French did not withdraw before they could be engaged. The British also learned that French gunnery had improved. The British were forced to limp away. As in most "Fighting Instructions" battles there were no losses.

Yet the "Fighting Instructions" had not yet finished their baleful influence. It has been said that two documents lost the British their American colonies: The Declaration of Independence and the "Fighting Instructions." In early 1781, the British had another chance to defeat the now reinforced French. In the Battle of Cape Henry however, the "Fighting Instructions" again stopped the British cold. The battle itself resembled Minorca, except that this time the British admiral was not shot. Yet the British refused to learn, even from this.

Never did this state of British tactics reach such a low as at the Battle of the Chesapeake. The French were attempting to blockade the British troops dug-in at Yorktown. They were, however, attacked by the British while disorganized. But the British, in conformity with the "Fighting Instructions" did not take advantage of this. The French retired, and were soon reinforced enough to maintain the blockade and force the surrender at Yorktown, one of the very few occasions when the Royal Navy failed to support the Army. The British lost no ships at The Chesapeake. They did, however, lose an army and the American colonies.

The situation was not much better in the Indian Ocean. There the British encountered the excellent French Admiral, Suffren. Between April 1781 and June 1783, Suffren fought six battles, one in the Cape Verde Islands and five in the Indian Ocean. While he did not lose or capture any warships in any of these six actions, his campaigns epitomized the French strategy of *guerre de course*. Rather than trying to engage the British in decisive combat, Suffren cut British supplies, interfered with trade, convoyed troops, and generally made a nuisance of himself. He was hindered in this by a bunch of maladroit and timid captains, but was aided by his British opponent, Sir Edward Hughes, who followed the "Fighting instructions" to the letter. If nothing else, Suffren proved that even the best conducted *guerre de course* could not win wars.

Yet out of this abyss of British tactical incompetence, a figure arose that was to revolutionize naval warfare for the remainder of the age of sail. The British situation in Europe was somewhat better than elsewhere, although Gibraltar was besieged and Minorca captured by the Spanish. The Spanish attempted to ambush a British relief force sailing to Gibraltar but were spotted and fled. The British, commanded by Admiral Lord George Rodney, pursued. Aided by their new copper bottoms, they caught many of the fast Spanish ships. This General Chase style battle led Rodney to reconsider his battle tactics. It was also one of the few night actions of the age of sail, and so it was called The Moonlight Battle. Rodney was one of the few British commanders willing to alter the "Fighting Instructions," despite the risk of Court-Martial. He was searching for a new, more decisive, way to beat the new, improved French and Spanish navies. At the Battle of Martinique, in 1780, he attempted the old Seventeenth Century tactic of massing his fleet against a part of the enemy's line. Unfortunately, his subordinates misunderstood the complex maneuvers involved and the battle remained indecisive. Rodney knew that there had to be a better way and, either on purpose or by accident, he found it when he brought the French combined North American and West Indian fleets to battle off the Saintes in April 1782. After a long chase, the British attacked, but not in the accepted "fighting Instructions" manner. The British split themselves into three parallel columns and broke through the French line, surrounding and outnumbering the French center and rear, while the French van fled. Although British communications problems and bad weather prevented a pursuit, the battle was still an important victory in that not only did it cripple the French fleet, but, more important, the era of decisive naval tactics had returned. No more would Britain's excellent admirals and captains be fettered to the corpse of a dogmatic "Fighting Instructions."

When the war ended in 1783, with the British losing colonies for a change, instead of winning them, the Royal Navy had lost four ships of the line captured, while capturing twenty-eight French, Spanish and Dutch ships of the line and destroying four. Almost half of that total were captured or destroyed by Rodney in his three battles.

THE WAR OF THE FRENCH REVOLUTION 1793-1802

The French Revolution of 1789, while it dramatically altered the French government, had less effect on the French Navy. Most ships had their names changed to ones in the revolutionary spirit, such as *Atheiste* and *Tyrannicide*. More importantly, there was a new crop of officers, who, events were to prove, were even less competent than the previous lot.

When Britain and the Revolutionary government of France finally clashed in 1793, the Royal Navy had taken Rodney's successful actions as a new precedent. This was coupled with reforms in areas such as promotion, provisioning, and other matters. The French were also hindered by the loss of much of their Mediterranean fleet, several ships of which defected to the British while others were burnt.

The revolution in French politics was not matched by one in their strategy. It was only the need to escort in a vital grain convoy from America that brought the French Atlantic Fleet out to sea. After several skirmishes, the main fleet was brought to battle three hundred miles off Ushant on 1 June, 1794. The British closed with the French line in many places, rather than the three columns Rodney used. Superior British gunnery prevailed. Six French ships were captured, and another one blew up. As in previous wars, the French had fired high, damaging the masts and rigging of many British ships and preventing an effective pursuit. As a result, most of the convoy reached port safely.

In 1795, there were several fleet actions in the Mediterranean. These were usually General Chase type battle and resulted in the capture of several French warships. Instrumental in these actions was a captain by the name of Horatio Nelson. There were also several smaller actions in the Atlantic, which were generally indecisive. If nothing else, the revolutionary fleet left port more often than its predecessors.

Although the Royal Navy had proved successful, they could not stop the French armies from defeating their opponents. Again, the British Expeditionary Force had to be evacuated from the continent. The Dutch, under a puppet government, allied with the French. The Spaniards also resurrected their long-time alliance with the French. The Royal Navy was able to handle all these, and find the forces to seize many enemy colonies as well. The Dutch were especially hard hit in this, and a sizable fleet in Ceylon had to surrender after the British had captured their base. Yet the strain was beginning to show, and in 1797, the Royal Navy was shaken by mutiny.

The first mutiny, at Spithead, the Channel fleet's base, was more of a sit-down strike. After living conditions had been improved, pay raised, and some harsh officers beached, things returned to normal. At the Nore, base of the North Sea fleet, things were more malicious, and it was only after weeks of negotiation and some bloodshed that the fleet returned to normal. The idea of mutiny was a

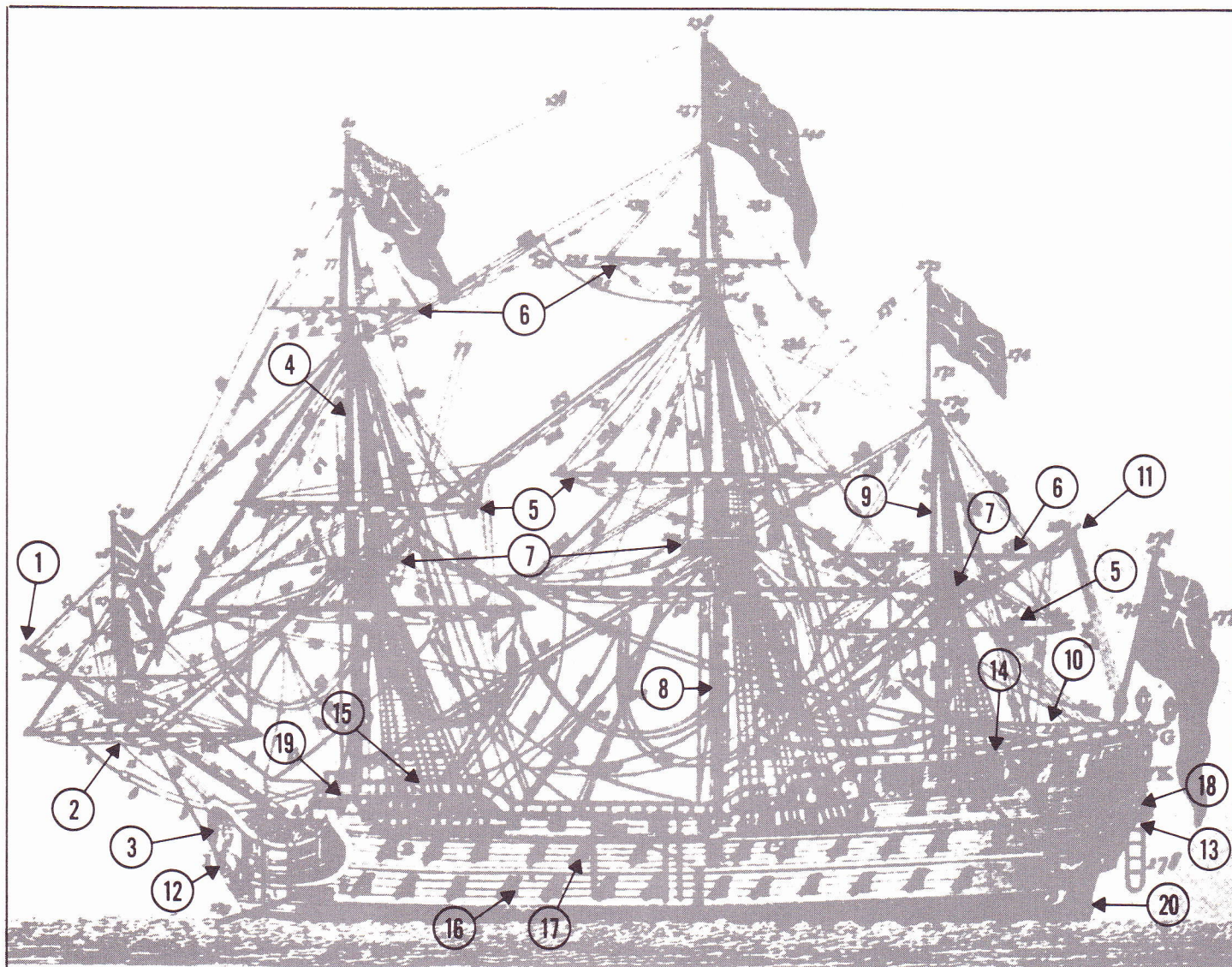
frightening one to the British, for the fleet was all that stood between them and the Revolution's victorious armies. It should also be remembered that the living conditions of the British sailor, while primitive by today's standards, was generally better than those of other navies, with the exception of the Danes, Dutch and Americans, whose sailors lived in comparative luxury. The British sailors' standard of living compared very well with most of their countrymen ashore. Yet the Royal Navy of 1797, wracked with mutiny, was to go on to win two outstanding victories.

The Spanish fleet had put to sea, although, as usual, they attempted to avoid action when intercepted by the British off Cape St. Vincent. The battle ended in a chase, with most of the fast Spanish ships escaping. Horatio Nelson, the British Second-in-Command, however, defied orders to capture two ships of the line with his flagship. Unlike previous practice, Nelson was rewarded. The Spanish fleet did not emerge from harbor for years.

Further north, a Dutch attempt to secure the North Sea for the passage of Dutch commerce was met by the previously mutinous North Sea

fleet. In the Battle of Camperdown, similar to the Saintes, the British formed in two columns and broke through the Dutch line, doing much damage with raking fire. The Dutch were severely mauled. This was the last battle fought by the once-great Dutch Navy in the age of sail, for after Camperdown they had few ships left.

In 1798, the French Army, commanded by Napoleon Bonaparte, invaded Egypt. The British Mediterranean Fleet, now commanded by Nelson, missed the French invasion convoys because of a lack of frigates for



A Typical Ship of the Age of Sail

This ship is H.M.S. *Intrepid*, a British third-rate launched in 1770, although any sailor of the period 1560-1830 would have felt at home aboard her. *Intrepid* fought in several major battles during the Wars of the American and French Revolutions and the Napoleonic wars, being scrapped in 1828.

Legend

1—jib boom, 2—bowsprit, 3—figurehead, 4—foremast, 5—topmast, 6—topgallant, 7—fighting tops, used by sharpshooters in battle, 8—main mast, 9—mizzen mast, 10—spanker boom, 11—spanker gaff, 12—bow, 13—stern, made of glass and containing officer's quarters, 14—quarter-deck, from where the ship was steered and commanded, 15—forecastle (fo'csle), where the crew lived, 16—lowermost gun deck, 17—upper gun deck, 18—top deck, 19—location of carronades, 20—rudder.

The complex system of ropes makes up the rigging. The horizontal attachments to the masts are yard-arms. Used for suspending sails and occasional malefactors. The jib would be found set between the foremast and the jib. Each mast would carry four sails, in order from the bottom being, the course, the main sail, the top gallant, and the royal. The spanker was set between 10 and 11. The figurehead was usually a heraldic device or an effigy of some heroic or mythological creature, or a member of the local royalty.

scouting. Nelson found them in the sheltered waters of Aboukir Bay. The result was the Battle of the Nile. Attacking at dusk, the British risking running aground, sailed between the French and the land. Which is exactly where the French were not expecting to be attacked from. The French could neither maneuver nor flee, and were thus almost totally destroyed. This action, which marked the demise of most of the French Mediterranean fleet, also stranded the French Army in Egypt, where it stayed until the British came around to accept its surrender in 1801.

By 1797, the majority of the enemy fleets had been defeated and blockaded in port. British warships remained, off the enemy coast, often for upwards of five years without being relieved. While enemy merchantmen dared not leave port, fast frigates would often attempt to

do so, engaging in the traditional Franco-Spanish commerce destroying that had proven ineffective in the previous wars. These frigates were met by British frigates, and in the resulting actions, the British were invariably victorious, and the captured frigates were added to the blockading squadrons. In 1799, an Anglo-Russian force captured the remnants of the Dutch fleet, almost without a shot being fired. The Dutch also lost almost all of their colonies, and the French and Spanish were not much better off.

In 1801, however, Napoleon, now First Consul, tried to form an anti-British "League of Armed Neutrality" around his "Continental System," which was aimed at cutting Europe's trade with Britain. The British retaliated by smashing the threat of "Armed Neutrality" at Copenhagen. Here they destroyed the Danish Navy, which, although almost immobile, could eventually have become a threat, as Denmark had joined the "Armed Neutrals." Nelson again braved shallow water to defeat the enemy ships at close range in Copenhagen harbor. When signalled by a nervous superior to withdraw, Nelson put his telescope to his blind eye and claimed he saw no signal. Copenhagen was one of several battles fought in this period against anchored ships, as Britain's enemies found out that shallow water was no defense against the Royal Navy. Especially when led by Nelson.

In 1802, however, the Armies of Revolutionary France had defeated almost every other European Army. While the Royal Navy could check their overseas advance and stifle French trade, they could not defeat their armies. With Europe weary of war, peace was negotiated between France and her enemies at Amiens. This was, however, to be only a brief intermission.

THE NAPOLEONIC WARS 1803-1815

The British had barely time to return the colonies they had captured and start to run down their navy when war began again in 1803. For the first two years, things were quiet as the British maintained their blockade and guarded against French invasion. But in 1805, Napoleon himself came up with a daring and original strategy that would, he hoped, allow him to invade England. Napoleon wanted the French Mediterranean and Atlantic fleets to slip through the British blockade in darkness or bad weather, and rendezvous in the West Indies. Napoleon believed that with their West Indian possessions and trade threatened, the British would send their fleet to the West Indies to stop the French. At that point, the French would dash back across the Atlantic, rendezvous with the Spanish fleet, and from there sail up the Channel, convoying Napoleon's Army to England.

To start with, the plan worked well. The French Mediterranean Fleet succeeded in slipping past the British. Due to a lack of frigates, the British, again under the indomitable Nelson, lost track of the French. It was only when they began to capture British ships in the West Indies that it was known where they were. Nelson followed the French, but warily. The French, however, were commanded by the cautious Villeneuve, and they quickly ran back to Europe. But instead of seizing the Channel, they ran into Admiral Calder's British Squadron off northern Spain. The battle became a general chase, with the French and their Spanish allies scattering. The British were hindered by the light wind, fog, and the slowness of their ships. After taking two ships, Calder stopped to reorganize. Although a

British victory, Calder was censured for not destroying the enemy. Villeneuve, now convinced the British were too strong for him, ran into the port of Cadiz, where he was reinforced by more Spanish ships. Nelson soon returned from his trip to the West Indies, and blockaded Cadiz.

In Paris, Napoleon was angry. If his armies could do the "impossible," why not his navy? He sent a series of nasty messages to Villeneuve, the last telling him to defeat the British or be relieved of command. For good measure, Villeneuve's replacement was sent on the journey to Cadiz. This stung Villeneuve to action. On 19 October 1805, the Franco-Spanish fleet left Cadiz. Nelson was nearby and chased them for two days. Finally on 21 October, Villeneuve formed his ships in line of battle in the lee of Cape Trafalgar.

This was the moment Nelson had been awaiting for years. His plan was a complex one. He divided his fleet into two columns, which would break through the line, not in one point, but in several, each column splitting up to divide the Franco-Spanish into three parts, and destroying each separately. This complex plan was made possible not only because of improved signalling techniques, but because of the high quality of the men he commanded. The entire action went according to plan. Villeneuve cooperated by holding his fleet still while the British reached down on them, hardly bothered by inaccurate Franco-Spanish gunfire. Then the British broke the line, and the battle became a melee, much as the ones of the Middle Ages or Seventeenth Century. Only this time, everyone on the British side knew what to do. One by one, the Franco-Spanish ships were mopped up by superior British seamanship and gunnery. One French ship exploded and by the time the pursuit was over, twenty-five Franco-Spanish ships had been captured, making the action the most decisive of the Age of Sail. While the British lost no ships, they lost the one irreplaceable element of their Navy: Nelson. He was shot by a French sharpshooter and died at the moment of victory, his life's work accomplished. Napoleon's dream of overseas conquest had vanished in an afternoon. The Royal Navy was triumphant. Not for more than a hundred years would another navy challenge the supremacy gained at Trafalgar, the most brilliant battle in the Age of Sail. The French Navy would *never* again fight a major naval battle. The Spanish never bothered to rebuild their fleet.

The British had accomplished all the ends of seapower simply by destroying the enemy's fleet. French, Spanish and Dutch colonies fell into British hands like ripe fruit. In those colonies which the British did not capture, they formented rebellion. All the French or Spanish could do against this was attempts at commerce raiding, with privateers or frigates. But if one of these raiders was caught by a British frigate, it was almost always captured, and, often within hours, added to the Royal Navy. The British were able to practice their seamanship and gunnery at sea, while their enemies rotted in port.

In 1807 the Danes were again going to join Napoleon's Continental System. The Danes obviously had not learned anything from 1801, so the British fleet landed troops which captured the entire Danish fleet, intact.

The next two years were filled with frigate actions and indecisive skirmishes between small groups of ships of the line. In 1809, a

Wargaming and the Age of Sail

Surprisingly, wargames were played during the latter part of the Age of Sail.

The first mention found of wargames came from Captain Perier de Salvert, who, in 1775, was part of a commission recommending reforms for the French Navy. The Captain recommended: "In each ship should be embarked a table five feet square, on which compass cards should be drawn for the moving of small models of ships made for the purpose, so young officers can learn tactical maneuvers." Unfortunately, this idea went the way of most French Naval reforms and was disregarded.

Admiral Lord Rodney is reputed to have "gamed out" his search for a usable tactic to supercede the antiquated "Fighting Instructions." He used cherry and peach pits in place of model ships, but the French flagship was represented by a lemon. Which, at least, is an alternative to cardboard counters.

Some years after Rodney, John Clerk, an Edinburgh merchant, wrote *An Essay on Naval Tactics* which made use of the more flexible approach Rodney's successes made possible. Clerk included in his book details of rules which could be used with "small models of ships which, when disposed in proper arrangement, gave most correct representation of the forces involved" to fight wargames. Clerk's book apparently was widely read and contributed to changes in naval tactics, but it is unknown as to what extent his wargaming suggestions were followed.

The Americans also found themselves involved with wargaming. In 1803, the midshipmen of the frigate U.S.S. *Philadelphia*, captured by the Barbary pirates, put their time to good use by carving models of ships. These models were then used to fight wargames under the direction of David Porter, senior midshipman, who was later to become a hero of the Civil War.

Wargames, although by no means a vital part of the age of sail, still had a place.

French squadron was trapped in Basque Roads in Northern Spain and eight ships of the line were taken or destroyed. The next three years continued much as before, but in 1812, the British and Americans blundered into war with each other. This inglorious little war has spawned much mythology, but the Americans joined the French in practicing commerce destruction. While they proved themselves a nuisance in this, this was hardly critical to British commerce, while the British blockade strangled the American economy to the point of starvation. In the early days of the war, the large American frigates scored some very embarrassing victories against the until now invincible British frigates. But the ship to ship actions were trivial, the British losing three frigates and thirteen smaller ships while taking three American frigates and eleven smaller ships in return. Yet it should be noted that the British loss represents almost half of their total frigate loss since 1793. This war did not reflect credit on either side.

The War of 1812 ended in 1815. A few months afterwards, Napoleon Bonaparte was bundled abroad the instrument of his Empire's demise — a British warship — and sent to St. Helena. The Second Hundred Years war had ended. Britain, through the use of the Royal Navy, was triumphant. The Royal Navy had maintained British trade, totally suppressed enemy trade, safeguarded British colonies, captured enemy colonies, supported the armies of Britain and her allies, evacuating them when Napoleon's armies gained the upper hand. The results of the end of the

Second Hundred Years War left Britain the world's foremost power until 1914.

In the period 1793-1815, the British lost in action four ships of the line, seven frigates, and approximately 100 smaller ships. In return they captured or destroyed, while fighting the French, Spanish, Dutch, Danish, Russian, Turkish, and American Navies, 166 ships of the line, 335 frigates, and 732 smaller craft (not including ships later recaptured). It was a record of victory never equalled before or since.

EPILOGUE 1816-1974

With the last great war of the Age of Sail over, the Great Powers of Europe, and the Americans, used their navies for the chastisement of pirates and other local nasties throughout the Mediterranean. This Mediterranean involvement included the participation of a fleet of British, French, Russian and Greek fleet in assisting the Greeks in their War of Independence from Turkey. The Turkish fleet, whose ships and tactics were similar to those of the Dutch Wars, were anchored in the shallow waters of Navarino Bay, off Navarino, and would not move. Because of this, the Allies were able to attack them piecemeal. The Turks fought hard, but when they saw the battle going against them they started burning and scuttling their ships. Navarino, which resulted in Greek Independence, was the last battle fought solely by sailing ships. It was not a sea battle, but a close inshore action on the model of the Nile or Copenhagen.

What spelled the end for the wooden fighting ship was the invention of shell ammunition. Unlike solid shot, shell would explode when it struck an object, which could be devastating to wooden ships. By 1837, the shell-firing gun was already in use in most forts and many ships. There was, fortunately, only one battle fought against wooden ships using shell-firing guns. That was at Sinope, in the Black Sea. In 1853, the Russian fleet which had shell firing guns, massacred the wooden Turkish fleet which lacked them. But this battle was also marked by something else new: steam. Most of the Russian ships had steam powered engines, although they retained their full rigging. Yet the new shell firing guns made steam mandatory. The shells could only be kept off by armor, and a ship weighed down by armor needed steam to move itself. Now armor, steam, and shell firing guns had changed naval warfare more in twenty-five years than it had changed in the preceding three hundred. Although sails lingered on as secondary power until the 1880's, a new age had dawned.

Or has it? In this age of fuel shortages, the Royal Navy is now considering putting sails on a frigate! While the masts would be retractable and computer-operated, there may well be a time when British sailors, the great constant throughout history, will once again go up the rigging to work the sails — as did the men who served with Hawke, Rodney and Nelson.



OUTGOING MAIL (continued from page 20)

ignoring it. It is only by incorporating the Army into the society and teaching its members how the society expects them to act that the military/sociological problem can be overcome. SPI has a chance of helping in this matter by incorporating its viewpoints into the games and reports it may do for the government. — Joseph H. Butler, APO New York

I am a US Navy medical officer, presently attached to a Destroyer Squadron staff. I am not a career military man, but a conscript, and I abhor war — although its history interests me. The officers with whom I have had personal contact, from a Rear Admiral on who's staff I served, to Junior Ensigns, have struck me as anything but irresponsible war mongers, eager to "kill and discipline." I can see how a game, for example, dealing with the prosecution of a sonar contact given certain circumstances and resources, will be invaluable to their effectiveness without danger of provoking them to fire a nuclear ASROC at the next "skunk" they encounter in the Med.

The present attitude of anti-militarism is an understandable reaction to the political and military errors of the last decade. If carried to extremes and allowed to undermine military capability, however, it can only lead to an early resumption of that which all responsible people wish to avoid.

— John T. Leyland, M.D.

I am a major in the Marine Corps, but I do not have the slightest connection to the Marine Corps project you refer to in your Outgoing Mail column. I am, however, in my present duties, charged with developing tactical training systems that will train officers to make better decisions in combat. Combat-like environments are strived for through computer software simulation (gaming) as well as real-time field exercise control. We hope to sensitize officers so that they become better tactical decision makers. Contrary to what Mr. Crandell has stated, we all also emphasize two things. One is that we do not duplicate any real or imagined real world situations, our results don't predict anything. The other is that

subjective factors like morale must be somehow brought into play if the systems are to produce reasonable and realistic results. I will not address Mr. Crandell's other comments, except to say that many of us are only too aware of our own weaknesses and tend to judge others by ourselves. All officers are human beings and individuals. They are also capable of analytical thought and personal views that differ as much as anyone's. I personally resent being stereotyped as a mindless minion. I feel we can do more to influence the system by working within it than by being outside it, but I also recognize the need for both types of people. After all, someone has to keep us honest, and I hope that "Simulations Publications, Inc." will continue to play their part, as you see it. — T.E. Jones, Major, U.S.M.C.

The following letter came from a subscriber who described himself as an "until recently, bored-ass lieutenant in USAREUR.

...I cannot close without a reference to all those satanic lieutenants and captains, each one holding his breath until he has enough rank to start a strategic thermonuclear war. Ha! I spent three years in Germany, and I believe the only way USAREUR is going to slow down the Russians is to block the roads with its wreckage. Maybe Colonels and Generals entertain illusions about our training and morale, but not us. If we (the ground forces) were sent against the Egyptians right now, we would suffer one of the most spectacular defeats in modern military history. I don't know any junior officer who wants to lead USAREUR troops in battle — none of them have a death wish. And neither do I.

— Gordon Crieghtan

The following letters contain insights that we are rather partial to, and we were pleased to see that subscribers were able to outline them before we had a chance to.

Eldridge Cleaver, and many others before him, said that if you're not part of the solution, you're part of the problem. SPI is not going to change all the weakness in our military into strength, and may not even reach the state of mind of those most able to

change deficiencies in the establishment, but it may have an effect on the thinking of future leaders.

Crandell takes for granted that the senior wargamers in the Pentagon will unthinkingly use optimum readiness and efficiency indicators to unrealistically assess the fighting quality of U.S. troops. This may be so. Cannot S&T build in factors to allow for different efficiency levels?

One of the major problems the military faces is that not enough civilians care enough to recognize or solve some of the problems. SPI has an opportunity to contribute to some solutions, even if only in a small way, by being on the scene and willing to act. If a person believes that civilians are routinely massacred in Vietnam then isn't it obvious that a B-52 pilot who refuses to go on a mission, or an infantryman who refuses to shoot a prisoner, exerts a greater influence on the conduct of war than a civilian with a sign on Pennsylvania Avenue? Act according to your own conscience in this matter.

— Robert R. Kresge

...In the intro to Napoleon at Waterloo, you wrote: "Game-simulations are merely another tool. How you use them is up to you."

Now this happens to be just exactly the philosophical position that Bertrand Russell took on the subject of knowledge in general. Russell maintained that knowledge is in itself, never "good" or "evil" but always morally neutral. Rather, it is the use to which a particular bit of knowledge is put by individuals that is subject to moral judgement. Thus, he felt that what was needed was not a decrease in knowledge, rather an increase in human judgement and wisdom.

It was on these grounds that Russell was, throughout his life, totally opposed to censorship of any sort. [While most people claim to be against censorship, in fact they usually merely differ as to what it is that ought to be censored.] However, it is interesting to note that Russell was not opposed to military security in time of crisis; thus, although he was opposed to England's participation in the First World War, and banned from the British coast because it was feared he might signal to German submarines,

Sackson on Games

I am always fascinated when I come across games that are off the beaten track. This time I am bringing you word about four most interesting discoveries. The last three are available only by mail order; the first in this column, although distributed through commercial channels, is by a newcomer to the adult game field.

THREE PLAYER CHESS, by Robert Zubrin, is a most successful attempt at enlarging the parent game. The ninety-six space board is the logical extension of the familiar sixty-four space board (which is also included with the game) and on it all the normal movement rules of *Chess* can be followed. Once the adjacency of spaces at the center are understood (and remembering that a knight's move can be looked at as one space diagonally followed by one space orthogonally, but not back to a space adjoining the starting space) the moves are not difficult to see.

Two strategically — or rather diplomatically — different versions are given. In the first, the player who captures another player's king uses that player's remaining pieces in his battle against the third player. In the second, the remaining pieces belong to neither player and cannot be moved. They can, however, be captured.

As in most three-player games there is often a tendency for two players to gang up against the third. A player who finds himself in this position can best respond by throwing all his power against only one of his tormenters. This opponent will soon see that he has to withdraw from the original alliance or face an unbeatable foe after the demise of the original alliance or face an unbeatable foe after the demise of the original target. This and other

short, but very pertinent, strategic points are covered in the instruction booklet.

Three Player Chess is published by Carter Hall, Inc., 6 West 32nd Street, New York, New York 10001 and lists for \$14.95.

NAVAL GAME is the latest creation of Allan Calhamer. In contrast to the vast canvas of his *Diplomacy*, *Naval Game* is a well-crafted miniature. Two play using a special deck of thirty-six cards and playing time is about fifteen minutes.

The game is based, very loosely, on the last great engagement between surface ships — the battle of Surigao Strait in 1944. Each commander has ten cards representing his fleet: one battleship, one heavy cruiser, one light cruiser, two destroyers, two destroyer escorts, one torpedo boat, and two submarines. Eight "open water" cards bring each set to eighteen cards. Each player secretly arranges his cards on half the spaces — checkerboard fashion — of a six by six square and records the positions. The cards, all face down, are then meshed into a square.

The various ships have different firing ranges — with the battleship being the most powerful. A "Fire Table" indicates which ships have the capacity of disabling others — with the submarine being the hardest to hit; only a Light Cruiser, Destroyer, or Destroyer Escort can do the job. On a turn a player normally turns up one of his ships and then one of the opponent's cards. If the opponent's card is a ship, it is within range, and can be hit by the original ship, it is disabled. A marker such as a coin or a paper clip is placed on the disabled ship, which is effectively out of the game. A player may choose to fire with a ship he has previously faced. In this case he turns up only an opponent's card which can be disabled in the usual manner. Occasionally a player may be in position to fire upon a face up opponent's ship with a face up ship of his own. If he chooses this option, no cards are faced in this turn. And, finally, a player may conduct a "reconnaissance" by relinquishing his opportunity to fire and simply turning up an enemy card. (These options are somewhat unclear in

the original rules, but Allan is contemplating a revision which may already have been completed.)

A player wins by disabling all of the opponent's ships. Often the game ends with each player having ships remaining that are invulnerable to attack. In this case the remaining ships are given a point value — from ten for a battleship down to one for a torpedo boat — and the player with the higher total is the victor.

In playing, the situation usually develops where a faced ship can immediately be disabled by another vessel which in turn can be immediately disabled, etc. This sequence has been termed "the chain." Knowing when to break the chain is an essential element in the strategy of the game.

Naval Game is published by Allan Calhamer, 501 N. Stone, La Grange Park, Illinois 60525 and sells for \$1.

5-5 is definitely related to *Backgammon*, but goes off in many new directions of its own. Two play using a paper board (similar to SPI games) on which the instructions are printed. The necessary die and checkers (or poker chips) have to be supplied by the purchaser himself.

The playing field is divided into spaces, twelve in one direction by eleven in the other. Roughly in the center is a five by three area that can only be entered through a "home lane" at one end. Each player starts with twelve checkers close to, but on opposite sides of, the home lane. Moving in accordance with the throw of two dice, the players attempt to maneuver their checkers around the central area — one clockwise and the other counter-clockwise — and to the home lane.

In the central area are five scoring spaces, with scores from one to five points. Once a checker is moved onto a scoring space it cannot move again. Once all five spaces are filled a second layer is started, but in this layer only the two-point to five-point spaces are used. A third layer uses the four and five-point spaces. And the final layer uses only the five-point space. When the pyramid is completed — with fifty-five points to be divided between the players — the game is ended, with the player placing the last checker receiving a ten-point bonus.

In moving around the board a checker — unless it is on a safety space — can be covered by an opponent's checker. This in turn can be covered, and so on without limit. Only the top checker of a pile can be moved and the others are trapped until released. If a player is unable to move his full dice throw the game ends immediately and the opponent adds a fifteen-point bonus to his score.

If both players are cautious, the game can be slowed excessively as each waits for the other to fill a low-scoring space, opening the next layer. There are a number of ways to eliminate this situation — one of the simplest being to give the player with the greater number of checkers in the central area a bonus of one point for each checker.

5-5 is published by Gabel Research, Box 1402, Ft. Lauderdale, Florida 33302 and sells for \$2.



ALIEN SPACE, by Lou Zocchi, is a space age battle of individual ship against ship. If two or three are playing, each is on his own. Four or more divide into alliances.

Eight spaceships are provided, in the form of four-inch cardboard squares. Each pictures a different ship (from Earth, Rojun, Zark, Dort, Repazoid, Kuzi, Rux and Zeron) surrounded by a circle divided into 360°. The ships are prepared for play by inserting a string through the center of the square and fastening it in place. A knot is made at exactly five feet and the string is cut at six. The direction of a ship's course is determined by stretching the string taut over the chosen heading in degrees and then moving the ship along the string. The string is also used in firing a ship's "blazers." The player again chooses a setting in degrees and any spaceship touched by the taut string is affected. However, due to the dissipation of the blazer beam, the sixth foot causes only half the damage.

Each spaceship has its own characteristics which are listed on individual "hit record" sheets. These sheets are removed from the rule booklet and should be encased in plastic to allow marking with a grease pencil (not supplied). In addition to recording "hits" these sheets are used for plotting the course, allocating the available energy, and firing weapons on each turn.

In general, the ships have main engines and auxiliary engines. Only the former can propel the ship at the speed of light ("warp one" =

two inches) or above (warp two, etc.). With an auxiliary engine the ship can only limp along at one inch on a turn. Either engine can be used for powering the ship's blazer batteries or for setting up defensive shields against enemy weaponry.

In addition to the blazer batteries which all except one of the ships carry, each ship — again with one exception — has its own unique weapon system. These ran through Proton Torpedos, Proton Mines, Magma Beams, Nytron Cubes, Gapper Zappers, Tential Beams, Javelin Torpedos, to Electron Stalker Pods. Rather than trying to explain these imaginative concepts to you, I will let you discover them for yourself, preferably — as suggested by Mr. Zocchi — when you first run across one in the course of an actual game. As you have undoubtedly gathered by now, *Alien Space* is played on the floor of a fairly large room. Not only are the ships themselves involved — including one that is intermittently invisible — but many of the special weapons leave trails that move or expand as the game progresses.

Alien Space is published by Louis Zocchi, 1513 Newton Drive, Biloxi, Mississippi 39532 and sells for \$4. I have received several inquiries concerning the availability of *Battle of Britain*. Lou tells me that he has boxed sets available for \$8.98. He has some damaged — but not enough to effect the play — sets which he will sell for \$8 boxed or \$6 unboxed (specify when ordering). The *Battle of Britain* revision booklet and PBM kit sells for \$3.



OUTGOING MAIL (continued from page 39)

there is no indication in his writings that he would ever have considered such a thing.

Although Russell has been accused of much inconsistency, I think the following summary of terms as he used them is helpful to clear thinking:

- (1) Military security consists of suppressing knowledge that could aid the enemy war effort.
- (2) Government control of the press for political purposes is often called censorship; actually, it is just another form of political repression.
- (3) Pure "censorship" consists of the suppression of knowledge as knowledge for its own sake, for moral (often religious) reasons.

The criticism leveled at you in S&T 42 can only be on grounds of definition "3." The exact same criticism can, and has been, leveled at the developers of atomic energy. Personally, I agree with Russell, that what is really needed today is an increase in wisdom — especially political wisdom — and an alert and educated populace seems the best way to even approach such an ideal. Certainly, the SPI series has been an important part of my own education along these lines. The games you have published are neither "good" nor "evil." Rather they are either "accurate" or "inferior" treatments of the respective subjects. — Mark Saha

...Since victory in war is preferable to defeat, the soldier must always occupy a position much like that of the funeral director or pawnbroker: everyone abhors his work, but they are indispensable. Frankly, I love the soldiers, every one, for they allow Mr. Crandell and me to pretend that we are more civilized than they are. — Bernard Lebarti

There are a few aspects of how and why SPI is run that subscribers should be made aware of, particularly those subscribers who are so vehemently against any contact by use with Defense agencies. SPI was founded by and continues to be staffed and run by people who are interested in publishing historical games. In fact, if one would like a definition

of what SPI exists for, it is to publish games. That is the end to which all other aspects of SPI are directed. This "goal" of SPI should not be underestimated. One of the prime means toward achieving this goal is a fiercely maintained ideological and economic independence by SPI. We are, after all, publishers, and that means we are creatures of the American Constitution's First Amendment. To surrender any part of this independence would be unthinkable. It would destroy the very reason for SPI's existence. Thus, most of the criticisms leveled against our cooperation with Defense Department agencies is without foundation. We may, as some subscribers insist, be playing with fire. We may even (as they also insist) eventually get burned. But we are not stupid, and we have no intention of being absorbed through the use of Defense Department money, or "Washington ego trips." In some respects, SPI's management has a "kamikaze" attitude. We would rather run the operation into the ground, than let our principles be compromised. Anyone who spends any time around here will soon realize that attitude is not just an abstract attitude. In fact, one of the reasons why SPI has come as far as it has, is because we have stuck to our principles, no matter what. And sometimes, the "no matter what" has been very ominous and grim, indeed. We are always ready to, as we put it, "go back to the basement" (a reference to our original 1970 basement headquarters in New York's lower east side).

Ironically enough, all of this talk about Defense Department cooperation is probably a tempest in a teapot. We have been approached by various Defense Department agencies because of the quality (or just novelty?) of our work. Our "standard" terms for doing a special project for Defense Department agencies as to say the least, unorthodox, by their standards. [Basic terms for doing a special game: \$20,000; \$10,000 up front, \$10,000 on delivery]. Basically though, we tell interested Defense Department agencies that their best bet would be to simply give us what information they can, and eventually, they'll get what they want for nothing since many of the projects they're interested in are usually quite topical, and also appeal to our

For readers who would like to keep up with the field of science fiction wargaming, *Supernova* is a must. Each issue — mimeographed, but quite legible — contains some twenty-two pages of game reviews, fanzine information, openings for postal play, a lively letters section, and frequent complete game rules. The price is a modest forty cents an issue. Lew Pulsipher, the publisher, prefers not to accept payment for more than three or four issues — an approximate year's output — in advance. For \$2.00 he will send five issues, two of which will be back numbers. The address is Lew Pulsipher, 423 North Main Street, Bellevue, Michigan 49201.

subscribers. We would rather produce such games for our subscribers and customers. Whatever the case, we won't handle classified material, if only because it compromises our journalistic function.

If nothing else (and there may be nothing else to it), this issue has at least clarified some of the reasons why SPI exists and some of the more potentially ominous outgrowths of our work. We are simply trying to present history, using a literary, as well as a game-simulation approach. We're not trying to "predict" World War III. Or tell those who might fight World War III how to go about it. We don't consider ourselves experts in the field of military, or even historical analysis. We're simply trying to do the best we can. And anyone who tries to infer more than is there is creating problems for themselves.

As a closing note, we would like to try and help some of those many people who write and ask us how they can "defend" their interest in wargames. The best "defense" is simply explain to people what the vast majority of historical gamers do with the games. Put quite simply (as numerous feedback surveys have indicated) the majority of "games played" are played solitaire. In other words, people play the games, by themselves, primarily as a means of studying a historical situation. A majority of "conventional" written history is concerned with the conflict situations in history. Most of these situations end up as "wars." Unfortunately, "wargames" are described using terms which do not accurately describe what they are all about. It is for this reason (and not euphemistically) that we have frequently used the term "conflict simulations." A conflict simulation is a game, but it is more than a game. Even more paradoxically, it is most frequently "used" not as a game, but simply as a source of information. Of course, you tell someone who is not familiar with conflict simulations that your wargames are not really "games" they won't understand, and you'll probably be worse off than when you began trying to explain what you were doing. What this shows is that the biggest problem you must overcome is one of fundamental ignorance of the part of most non-gamers (and to a certain extent, gamers

themselves) concerning what the games are really about. One of the reasons for *S&T*'s existence is to show, quite graphically, and in concrete terms, what the relationship is between conventional written history, and history delivered by means of a conflict simulation. We are also dealing with societal and psychological factors. That is, war in our society is (thankfully) unadmired, but at the same time "games" are considered "kid stuff." Thus, when you combine the two (war — games) you get something of an unfavorable knee-jerk reaction from most people. This will undoubtedly continue to be a problem until simulations are more widely accepted as a means of obtaining information about real-life situations. We are all going to have to live with the situation. It's the sort of thing that has time as the main part of its solution.

...But in the meantime, if someone tries to put you up against the wall about it at a cocktail party, you might try some variation of this argument: "If instead of wargames, I was interested in pathology and did mathematical models of cancer growth, would you consider me a 'cancer-monger'?" —RAS)

One final note. For those you who want to get a look at our as yet unpublished games, or simply to play games, try one of the SPI Game Orgies. They run for 48 hours straight in eight six hour sessions. Much of SPI R&D staff is there also (mainly to play games, these "orgies" are for the staff's benefit also). All you have to do to attend a session is to buy one game (that's all). Next orgy is from 5-7 July. It starts at 7PM Friday and runs straight through to 7PM Sunday. You can sack out at SPI if you want (we have a shower on the premises) and you can reserve a seat at a session in advance.

FEEDBACK RESULTS *S&T* 42

Rank	Article	Rating
1	East is Red (article)	7.14
2	East is Red (game)	6.97
3	Outgoing Mail	6.88
4	Napoleon at Waterloo	6.79
5	For Your Eyes Only	6.37
6	Pass in Review	5.26
7	Sackson on Games	5.01
This Issue (overall)		7.06

AH = Avalon Hill; SPI = Simulations Publications; GR = Games Research of Boston; GG = Guidon Games; CGC = Conflict Games Company; LZ = Lou Zocchi; SDC = Simulations Design Corporation; WRG = Wargames Research Group (UK); * = Indicates designed by or originally published by SPI. "Acceptability"—Overall popularity of the game. "Percent Played"—Percentage of those who at one time or another played the game. "Complexity"—How complex the game is on a One to Nine scale with One being simplest. "Average Game Length" (time to play)—Given in hours.

Generally, the average rating for Acceptability is about 6.00; for Complexity about 5.00. Games are usually rated about twice a year; new games are rated twice in a row (that is, in two *S&T* feedbacks in a row) and their second rating is usually a half a point or so below their initial rating. It is the second rating that will determine a game's general acceptability level for the subsequent couple of years. Avalon Hill games not designed by SPI are given a five percent higher rating than they received from our "volunteer" feedback respondents. This makes their ratings statistically compatible with the ratings of all other games in the survey. The ratings thus shown in the Game Ratings Chart represent the opinions of twenty-thousand-plus *S&T* subscribers who play conflict simulation games. Game Acceptability tends to decline with the age of the game and fluctuates with the current popularity of the game's particular period. We have found that games published in *S&T* would have a seven to ten percent higher rating if they had been published outside of the magazine.

GAME RATING CHART

	Pub.	Date	Accept. Rating	% Played	Complex. Rating	Avg. Game Length
GREATEST ACCEPTANCE						
1. World War II	SPI	11/73	7.57	29	6.10(e)	3-3.5
2. Sinai	SPI	12/73	7.50	28	5.50(e)	2-5.3
3. Sniper	SPI	9/73	7.38	31	6.90(e)	3-3.5
WIDE ACCEPTANCE-TO-GREATEST ACCEPTANCE						
4. PanzerBlitz	AH*	10/70	7.25	77	7.04	2-2.5
5. Red Star/White Star	SPI	12/72	7.23	45	6.38	2-2.5
6. NATO	SPI	7/73	7.08	26	5.98	3-3.5
7. Desert War	SPI	11/73	6.99	23	5.80(e)	1-5.2
8. PanzerArmee Afrika	SPI	10/73	6.98	74	5.20(e)	2-5.3
9. France 1940	AH*	4/71	6.93	63	5.78	2-5.3
10. Borodino	SPI	4/72	6.90	55	2.59	1-5.2
11. Richtofen's War	AH	3/73	6.88	31	4.35	0-5.1
12. Soldiers	SPI	8/72	6.73	27	5.51	2-2.5
13. KampfPanzer	SPI	12/73	6.69	70	5.50(e)	1-1.5
14. La Grande Armee	SPI	10/72	6.69	36	5.25	3-3.5
15. Kasserine Pass	CGC	3/73	6.67	6	4.33	2-2.5
WIDE ACCEPTANCE						
16. Diplomacy	GR	6/61	6.66	42	4.34	6-6.5
17. "CA"	SPI	6/73	6.65	78	4.59	1-1.5
18. Breakout & Pursuit	SPI	12/72	6.64	22	5.36	2-5.3
19. American Revolution	SPI	12/72	6.62	21	4.03	2-2.5
20. Solomons Campaign	SPI	9/73	6.60	18	6.80(e)	2-2.5
21. Turning Point	SPI	2/72	6.56	24	5.36	2-5.3
22. Winter War	SPI	8/72	6.54	59	4.54	2-2.5
23. Foxbat & Phantom	SPI	6/73	6.54	21	5.41	1-1.5
24. Wilderness Campaign	SPI	12/72	6.50	21	5.36	2-5.3
25. Musket & Pike	SPI	3/73	6.50	12	4.76	2-5.3
26. Ardennes Offensive	SPI	4/73	6.47	20	6.24	3-3.5
27. Napoleon at Waterloo (Expansion)	SPI	2/72	6.46	46	3.49	1-5.2
28. Kursk	SPI	6/71	6.43	29	5.50	3-3.5
29. USN	SPI	12/71	6.41	49	8.11	6-6.5
30. Bull Run	SPI	9/73	6.39	15	5.40(e)	2-5.3
31. Blitzkrieg Module System	SPI	12/69	6.38	22	6.29	5-5.5
32. Strategy I	SPI	6/71	6.36	33	7.87	6-6.5
33. Moscow Campaign	SPI	8/72	6.36	24	5.54	2-5.3
34. Overlord	CGC	5/73	6.35	6	4.40(e)	2-5.3
MODERATE ACCEPTANCE						
35. Korea	SPI	2/70	6.32	27	5.63	3-3.5
36. El Alamein	SPI	9/73	6.30	17	5.85	2-5.3
37. Grenadier	SPI	12/71	6.26	24	5.81	2-2.5
38. Battle of the Bulge	AH	4/65	6.21	58	4.69	3-3.5
39. Barbarossa	SPI	12/69	6.17	33	5.16	3-5.4
40. Barbarossa	SPI	4/73	6.17	17	5.43	2-5.3
41. 1812 (Hex)	SPI	10/72	6.16	18	5.03	3-5.4
42. Blitzkrieg	AH	10/65	6.14	70	5.83	5-5.5
43. Austerlitz	SPI	2/73	6.13	13	4.00	2-2.5
44. 1812 (Area)	SPI	10/72	6.12	19	5.30	3-3.5
45. Leipzig	SPI	12/69	6.07	23	5.27	3-3.5
46. Verdun	CGC	11/72	6.06	5	4.67	2-5.3
47. Battle of Moscow	SPI	10/70	6.03	24	4.21	2-2.5
48. Battle of Britain	LZ	4/68	6.02	40	4.69	3-3.5
49. Normandy	SPI	12/69	6.01	27	5.56	3-3.5
50. Alexander the Great	GG	6/71	6.01	8	4.00	2-2.5
51. Stalingrad	AH	4/63	6.00	59	3.94	3-3.5
52. Year of the Rat	SPI	12/72	5.97	70	5.13	2-2.5
53. Afrika Korps	AH	4/64	5.96	64	3.54	2-2.5
54. 1918	SPI	4/70	5.95	16	4.61	3-3.5
55. Rifle & Saber	SPI	2/73	5.93	16	4.16	2-2.5
56. Midway	AH	10/64	5.91	55	4.71	2-5.3
57. Waterloo	AH	4/61	5.91	52	3.32	2-2.5
58. Destruction of Army Group Center	SPI	2/73	5.88	76	4.63	2-2.5
59. Franco-Prussian War	SPI	8/72	5.85	22	5.61	2-2.5
60. Battle of the Marne	SPI	10/72	5.84	13	4.27	2-2.5
61. Spitfire	SPI	4/73	5.77	14	4.68	1-1.5
62. Dark Ages	SPI	10/71	5.74	20	5.13	1-5.2
63. Luftwaffe	AH*	4/72	5.73	58	5.83	3-5.4
64. Napoleon at Waterloo	SPI	12/71	5.68	81	1.62	1-1.5
65. Armageddon	SPI	10/72	5.68	50	4.82	1-5.2
66. Phalanx	SPI	10/71	5.57	26	5.30	2-2.5
67. D-Day	AH	4/61	5.46	58	3.93	3-3.5
68. Renaissance of Infantry	SPI	8/70	5.44	23	4.85	2-5.3
69. Origins of World War II	AH*	10/71	5.39	43	3.74	1-5.2
70. Flying Circus	SPI	4/72	5.38	43	3.19	0-5.1
71. Combat Command	SPI	2/72	5.31	43	6.30	2-2.5
LOW ACCEPTANCE						
72. NORAD	SDC	5/73	5.23	13	2.20(e)	1-1.5
73. Centurion	SPI	12/70	5.15	28	4.70	2-2.5
74. Fall of Rome	SPI	8/73	5.11	77	6.50(e)	3-3.5
75. Fight in the Skies	GG	4/72	5.02	7	5.30	2-2.5
76. Flight of the Goeben	SPI	6/70	4.98	21	4.35	1-5.2
77. Gettysburg	AH	6/58	4.96	58	3.10	2-2.5
78. Anzio Beachhead	SPI	4/70	4.95	25	4.09	1-5.2
79. Bastogne	SPI	4/70	4.78	23	6.29	3-5.4
80. Grunt	SPI	4/71	4.77	33	4.95	1-5.2
81. Lost Battles	SPI	10/71	4.75	27	6.65	2-5.3
82. Tactics II	AH	6/58	4.32	47	2.41	1-5.2
83. Scrimmage	SPI	4/73	3.70	76	6.01	1-5.2
84. Kriegspiel	AH	4/70	2.97	50	2.91	1-5.2

For Your Eyes Only!

"For Your Eyes Only" is written by the same people who write *Outgoing Mail*. Where *Outgoing Mail* concentrates on what we produce, *For Your Eyes Only* concentrates on how we produce it. In other words, *For Your Eyes Only* is something of a peek into the backroom at SPI. And an ongoing explanation of what goes on there and why.

Having only recently cleared up many of the problems we had delivering goods to our Canadian subscribers, we still have problems with our subscribers and customers in APO/FPO (Army Post Office/Fleet Post Office) areas. The basic problem here is that we cannot deliver via UPS, which is by far our most efficient means of delivering games. UPS gives, for parcels, the equivalent of first class mail service at the same price as third class postage. Some 5% of our orders are delivered to APO/FPO addresses, and as things now stand, there seems little we can do to improve this service. We are at the mercy of the military mail delivery service.

In a number of recent games we have been using, for otherwise unidentifiable units, "letter codes." These letter codes consist of one capital letter and a second lower case letter. Some people have mistaken these alphabetic codes for abbreviations of actual units. This is not the case and it's our fault for not more fully explaining the identification system used.

As you can see from the brochure included in this issue, we have established a new pricing policy for buying games. What we have done, in effect, is lowered the price of games to \$6.00 each when three or more \$8 games are ordered. What has been responsible for this, more than anything else, is not so much economies of scale (more people buying more games), but rather simply good management. We've always kept very careful track of our income and expenses, and devoted considerable time, talent, and energy to analyzing both our income and expenses. The result of our four years of experience, and the many hundreds of hours of analyzing the nuts and bolts of our business, has been our new pricing policy. As we have mentioned many times before, the manufacturing cost of a game is actually quite low. Currently it averages approximately \$1.70 for our normal \$8.00 game. The usual rule of thumb in the game industry is that your selling price should be approximately six times your manufacturing costs. Now SPI's operation is by no means normal or traditional. Whereas most other game companies manufacture in runs of 10,000 or more units, our initial run is usually between 2 to 5,000. If we did our games in runs of 10,000 our manufacturing price would be close to one-sixth of \$8.00 (that is, \$1.30-1.40). The key to our new pricing policy is the fact that we sell most of our games by mail. While we receive, theoretically, \$8.00 per game sold by mail compared to only \$2.60 per game sold in a store (middle men get all the rest!), there are additional costs in selling by mail that we do not have in selling in the stores. These additional costs include: processing the order (including the average customer service costs), as well as postage and shipping. While the manufacturing cost of the game is the same, the processing and shipping cost is divided by the number of games in an order. For example, if we receive an order for one game, it costs us \$5.40 to get that game out the door (this includes the cost of the game plus processing and shipping). Thus, if we charge \$8.00 for this game we only have a gross profit of \$2.60 (the gross profit must provide the money we need in order to expand our operation, as well as supporting those aspects of the operation which do not fully pay for themselves, such as *S&T* itself). Now if the order we receive is for two games, the average cost per game is only \$3.55, thus if we charge \$7.00 for each game, we make a gross profit of \$2.45. Now if we receive an order for three games,

the average cost per game is \$2.93, thus if we charge only \$6.00 for each game, our gross profit is \$3.07. An order for six games costs us an average of only \$2.43 per game; thus giving us a gross profit of \$3.57 per game.

Producing new games is a rather expensive proposition. Right now it runs us approximately \$10,000 to launch a new game. Some games, of course, are much more expensive, such as *War in the East* which cost us something like \$24,000 to slide down the ways. For the average game, however, a little less than half of the \$10,000 actually goes to pay direct R&D expenses (about \$4,500). Another \$2,500 goes to pay for our perpetual inventory, that is, the amount of money we will have on the average tied up in unsold units of that game. The remaining \$3,000 for a new game is promotion, usually two full-page ads in *S&T*. That's right, *S&T*, in effect, charges SPI's R&D department for the ads announcing a new game. This, while being an internal bookkeeping affair, does give us a means of keeping track of how effective *S&T* is in advertising our own games. Also, on paper at least, it makes *S&T* a breakeven (although not profitable) operation. Of course, the whole basis of SPI's operation has been to sell issue-games at cost and thereby encourage people to buy some of the boxed games after sampling our wares in *S&T*.

The \$1.70 manufacturing cost per game is about evenly divided between the box, which runs us about 80 cents (including a front sheet), and the printing and die-cutting of the other components. Unfortunately, like most things in life, there is far more involved in getting that game out the door than simply manufacturing it. And this is why games cost \$6-\$8 and not \$1.70. The manufacturing cost of an issue of *S&T* (including the unboxed game) is a little over a dollar. The other \$5 or \$6 is taken up with processing the order, postage, customer service, and sundry other expenses. It does add up, and controlling these expenses is one of the efficient ways of reducing, or at least maintaining, the cost of these items, as well as providing additional money to improve them in the future.

In the past few months some 20% of our subscribers received a mailing from a new game company called "Rand Game Associates." It was first suspected, and later proven to be true, that they had used part of our mailing list. At first this was a mystery to us, as we had no knowledge of these people. We had no idea where they got the list. As it turned out, they got our list as it existed when we mailed *S&T* 33 (when we had some 12,000 subscribers, a large number of which have since moved). We have ascertained what we believe to be the source of their getting the mailing list, but because it may all end up in a law suit, we can't go into too much detail now. Conversations with people at Rand, however, lead us to believe that we will be able to settle this matter out of court, and hopefully, to everyone's satisfaction. However, the damage has been done.

It has always been our policy to carefully scrutinize any firm (and their products) wishing to contact our subscribers through our list or *S&T* itself. This is mainly to protect our subscribers who have been burned (usually unintentionally) by fly-by-night game companies. In this case we were unable to check out Rand Game Associates. Usually we require a new game company to "survive" (and deliver the goods to their customers) for a year before we will help them sell their wares to you. We have received numerous letters and phone calls regarding the Rand Game Associates and all we can really say is that we haven't seen them operate long enough to be able to give any sort of endorsement. We cannot guarantee their performance, so you're on your own folks. Caveat Emptor.

There are some game companies that *have* survived the test of time (well, at least a year). Two of these are Conflict Game Company (publishers of *Kasserine Pass*, *Verdun*, etc.) and Game Designer's Workshop (publishers of *Drang Nach Osten*, *Eagles*, etc.). To a certain extent, Simulations Design Corp. (publishers of *Conflict Magazine* and *Dunquerque*) also belongs in this group, although SDC took two years to deliver the first six issues of their bi-monthly magazine. Lowry Enterprises have also had their ups and downs, but have generally stayed around and more

or less delivered the goods. Third Millennium Corp. (*Battle Flag*) has, as far as we can tell, folded, and one new company, Liberator Games, has, as of 1 May, apparently not delivered anything at all, even though they have been holding some orders for three or four months.

Usually, we receive a lot more information on these new companies than the individual gamer. If only because people, when contacting us to ask for information, often give us a little. One reason why we have been very open about how we operate SPI is because we want to see as many games published as possible. Unfortunately, all the advice in the world is not much of a substitute for experience. Something we had to acquire painfully (painfully for ourselves and for our customers). Small businesses in general, and publishing companies in particular, have a notoriously high failure rate. The Small Business Administration feels that the first three years of any new venture are the most critical. Any company that survives the first three years has a good chance of becoming a stable, on-going operation. We use a somewhat more liberal criteria, only asking for one year of operations before we commit ourselves to allowing these people to use the pages of *S&T* to advertise their products. In the short run, this policy costs us a certain amount of money. Obviously, the best place to advertise new games is in the pages of *S&T*. Given the track record of many of the new companies, we could take their money for an ad, watch them fold six months later, and in effect, leave our subscribers holding the bag. In the long run, this policy would probably cost us a lot more than the price of a few ads. So, to sum up, we ought to reiterate the small print that appears on the masthead of *S&T*: "Publication of paid advertisements in SPI publications does not constitute an endorsement by SPI of the goods or services offered. SPI does, however, attempt to prevent fraudulent or misleading paid advertisements from appearing in its publications. SPI reserves the right to reject any paid advertisement it considers misleading or harmful or offensive to the sensibilities of the editors and readership."

"Advertisements of SPI products are backed by a guaranteed credit or cash refund (upon prompt refund of the product) if the buyer is dissatisfied, or replacement if the product is damaged in transit."

While we can't vouch for any game company other than SPI, we can and do take measures to prevent our subscribers from being victimized.

No matter how often we say that we cannot handle them, we continue to get requests for us to accept games designed by non-SPI staff. The reason for our not taking outside games is basically quite simple. We have found (the hard way) that the only efficient way to do a game is to use a fairly large group of "Specialists" who are in constant contact with one another. As you will see in the design credits of our games, it takes about eight people, on the average, to successfully complete a game. The game designer is only one of these people. While it is true that you need a Designer to get the show started, you really must have all the rest of those people to successfully complete and publish the game. We have sold so far, over half a million games to over 50,000 different people. The feedback from a large portion of these people has indicated that our method is highly successful (perhaps the most successful) that has been developed to date, for producing games. For this reason, we do not take outside game designs.

Ever since issue 36, we have been asking a question on how long it took you to receive your mail order SPI products. The main reason we asked that question was because around the time issue 36 was published, we were having considerable problems getting the goods out in a timely fashion. Our track record has since improved considerably, and the responses to "Question 29" have become correspondingly more favorable. For example, based on the responses in issue 36, only 9% of you were receiving your goods in less than three weeks. This figure includes only those of you who are able to receive the goods via UPS. This covers about 80% of our customers. The rest of you take anywhere from 6 to 9 weeks depending on whether you are in the United States or not. In early 1973 (about the time of issue 37), 18% of you were receiving your goods within three weeks. By April, '73 this was up to 28%. And this remained fairly constant up through August of

WAR IN THE EAST

- The biggest game ever produced
- 2,000 counters and a 56"x 44" map
- 200-turn Campaign game and four Scenario games

On 22 June 1941, began a struggle of epic proportions between Germany and Russia, which has had no equal in history. These two nations waged total war against each other with a ruthlessness not seen since the Thirty Years War. The Russian armed forces lost some 13.7 million dead and missing during the fighting, plus another 11 million civilians. The German armed forces lost some two million dead or missing plus another two million civilians killed (primarily during the last six months of the war).

War in the East is a corps/division/brigade level simulation designed to recreate the mobile battles fought back and forth over the endless steppe. The 44"x 56" mapsheet (four times the size of a normal map) covers an area from the Arctic Ocean to the Turkish border, from the Urals into Poland and Hungary. Each mapsheet hex represents thirty-three kilometers of real distance and each Game-Turn represents one week of actual time. Two-thousand die-cut counters (on five 400-unit countersheets) represent the Russian, German, Finnish, Slovak, Hungarian, Rumanian, Bulgarian, and Italian forces which took part in the struggle.

The basic mechanics belong to the *Kursk* family of games. However, the very scope of this game gives it a flavor all its own. On a given turn, each side has an average of 250 combat units on the map. As the Axis Player, you can have huge pockets of Russians and still be faced with a solid front of Russian units, often two deep. As the Russian Player, you are trading ground for time, drawing the Axis out of supply while attempting to build up reserves for a counter-offensive.

One of the outstanding facets of the game is the Russian production. The Russian Player is not committed to a set Order of Battle in the Campaign Game. He has the option to build almost anything, from anti-tank brigades to artillery corps, from infantry divisions to air armies. This is done by appropriating population and armament points toward production of a unit and then having to go through a Training Center for a set period of time. The cost and time factors involved vary with the size and type of a unit. As the Russians you are presented with many of the decisions the Soviets faced concerning production during the war. If you were to gear production toward the eventual offensive by building air, artillery and armor, in all probability the front will dissolve before these units are ready in quantity. It takes a careful balance

in order to prevent this, and you are always faced with the problem of not enough people since the Axis are usually occupying most of the population centers.

Even the air battles which raged overhead are taken into account. This is done with a simple air point system, by which the players simultaneously allocate air-to-air combat missions or ground support. An initial surprise rule allows the Germans to catch the Red Air Force on the ground. The result is Axis air superiority for 1941. During 1942 and early 1943 the two air forces are relatively even and a shrewd guess would give one side a tremendous amount of ground support for a week. By late 1943, if the Russians are still around, their production of aircraft will usually overwhelm the Luftwaffe. The relative simplicity of these air rules is a minor breakthrough in game design. The importance of this part of the war is shown while leaving out all the complications one would normally expect.

Another interesting side to the game is the ability of infantry to force march. This allows the infantry to double its movement for one Game-Turn. There is, of course, the chance that the unit will dissolve on you and a sudden gap will appear in the line. During the early course of the game you have the Russians force-march away from the frontier toward a pre-determined defensive line while the Axis force-march further and further out of supply in order to catch the retreating Soviet forces. The result is that the majority of Axis units spend the first winter out of supply.

Of course, we have incorporated three factors without which this would not be a game on the war in Russia — fortifications, partisans and weather. There are special rules for all of these features. Russian infantry divisions have the ability to dig themselves in. This causes the unit to lose its Zone of Control but in return, triples the 1 Combat Point division and doubles one other infantry unit which doesn't lose its Zone of Control while stacked with it. Partisans appear by various die rolls on destroyed Russian infantry and cavalry units. And finally, the weather. There are three conditions: normal, mud and snow. The effects of weather vary with the season. To reflect the severity of the first winter on the unprepared German army there is a special frostbite rule.

To simulate the German ability to improvise and their inability to totally destroy Soviet units, we have included battlegroups.

These are the remnants of destroyed divisions and corps. Not only is this done for armored units as in previous games, but also for infantry. In this way you can still have a line even after suffering tremendous casualties. The battlegroups are printed on the reverse side of the units in order to ease play.

There are four scenarios (Barbarossa, Stalingrad, Zitadelle, and the Destruction of Army Group Center) each of which lasts twenty Game-Turns. In addition there is a campaign game of *over two-hundred Game-Turns*. The Barbarossa scenario covers the early campaign. Basically, the Russians are giving ground quickly to save troops. The Germans are trying to kill units and seize the centers of population. In the Stalingrad scenario, the Germans are getting over the close call of the Soviet Winter Offensive. Although weakened, they still have the ability to break the line anywhere and often in two spots. This is the only scenario where the Germans have a chance of taking Moscow. The Russians are faced with a strong German army starting at the gates of Moscow. A very tight game ensues as the Russian attempts to plug the gaps. Zitadelle is a very interesting scenario. Because of the Soviet defensive forces, the Axis cannot hope to attack, but must fight a mobile defense. The Soviets are faced with bludgeoning their way through the Germans at terrible cost. The Destruction of Army Group Center scenario provides the Germans with a desperate situation which will tax even the best player. The campaign game allows both sides to "correct" the mistakes of history. Perhaps you can win in 1941 as the German. The myriad possible strategies which may be employed should provide many hours of contemplation and debate.

War in the East is the culmination of all Eastern Front games. All the years you have waited have been worth it as we can now give it to you in a highly finished state. *War in the East* is available (boxed) from Simulations Publications for \$20.

Now Available!